THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXII. No. 1857.] LONDON, DECEMBER 13, 1898. [50TH YEAR. PRICE 6d.

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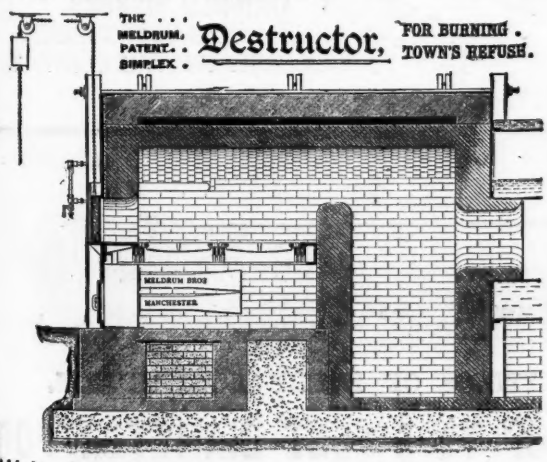

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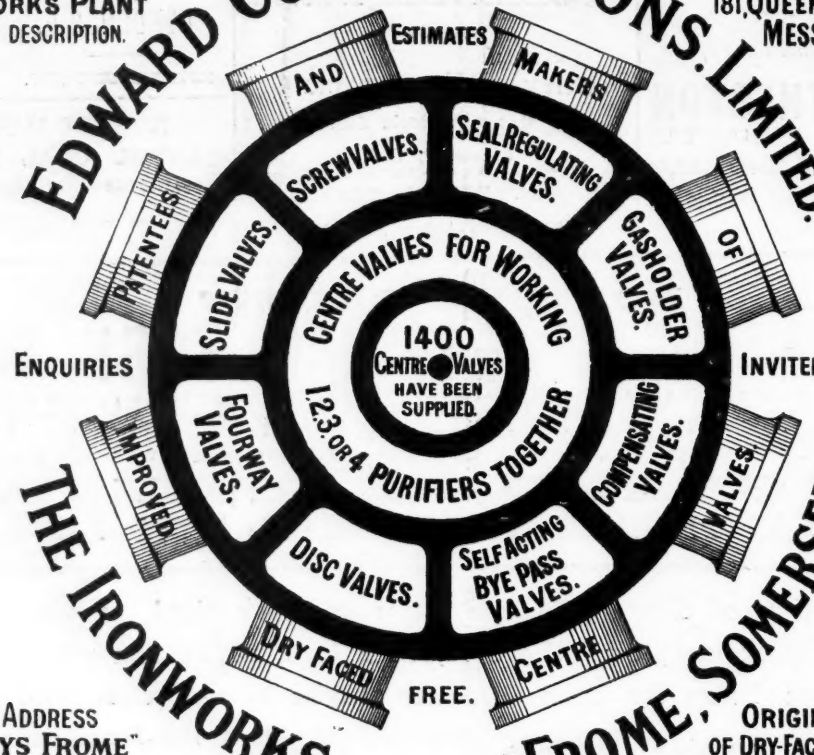

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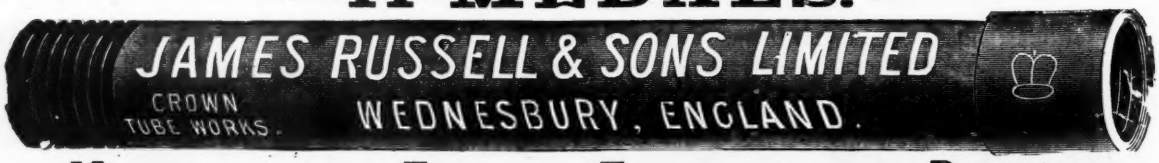

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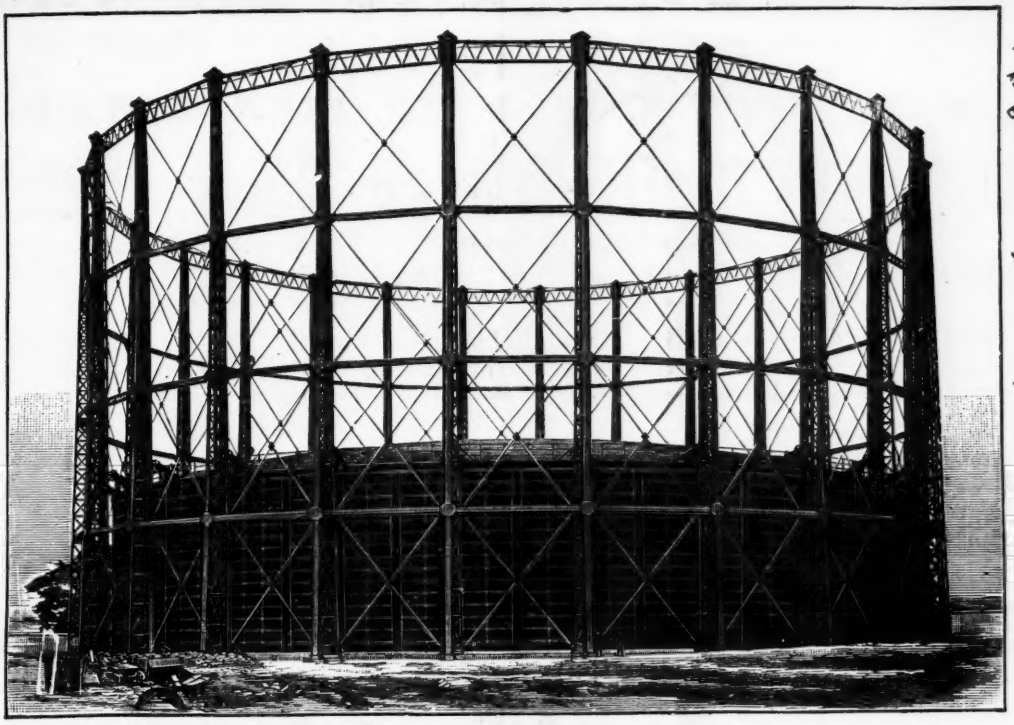

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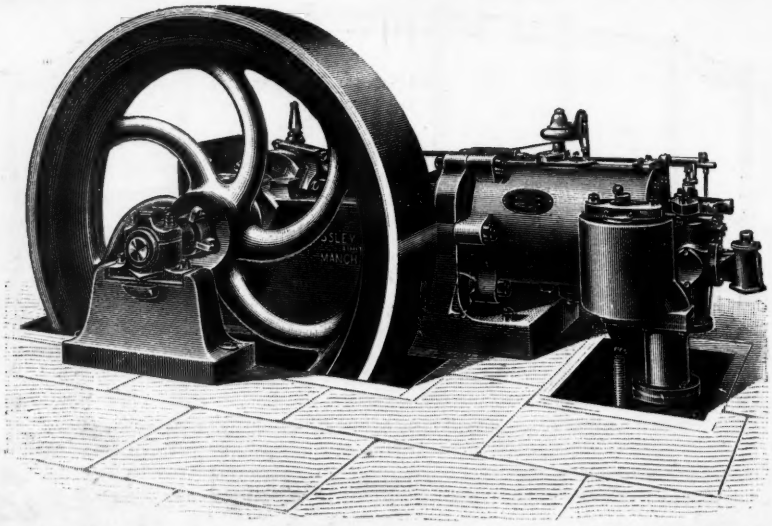

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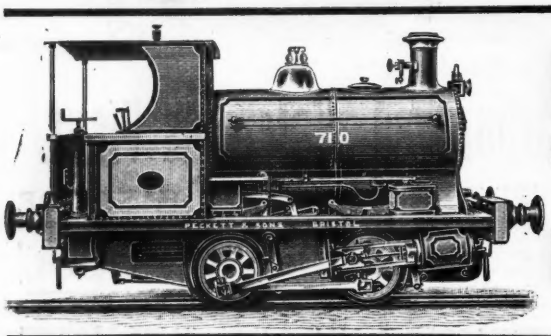

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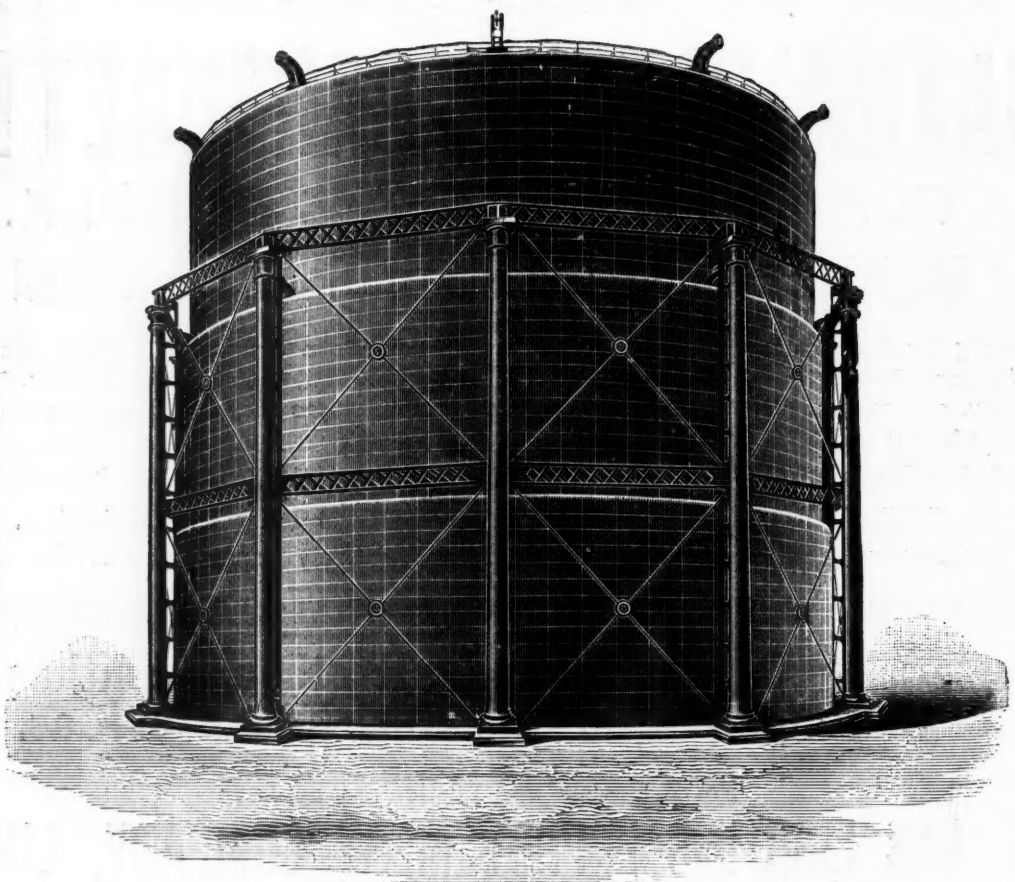

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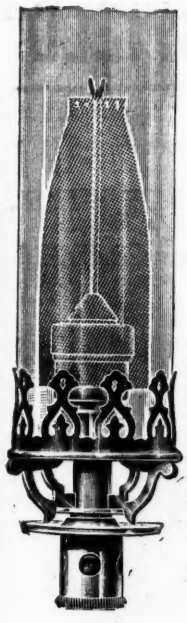

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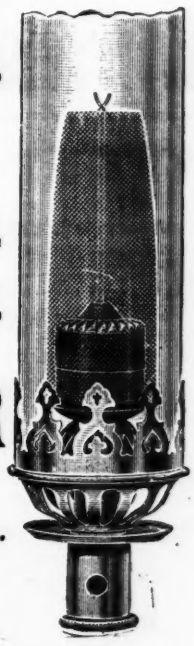

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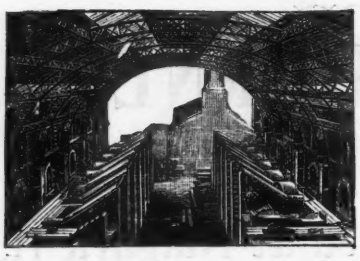

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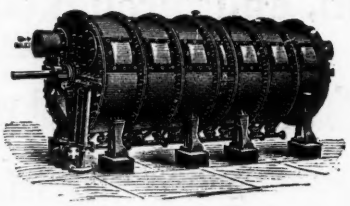

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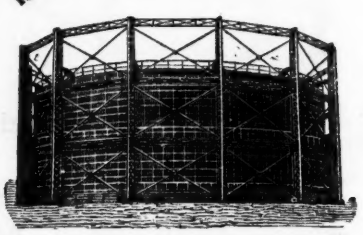

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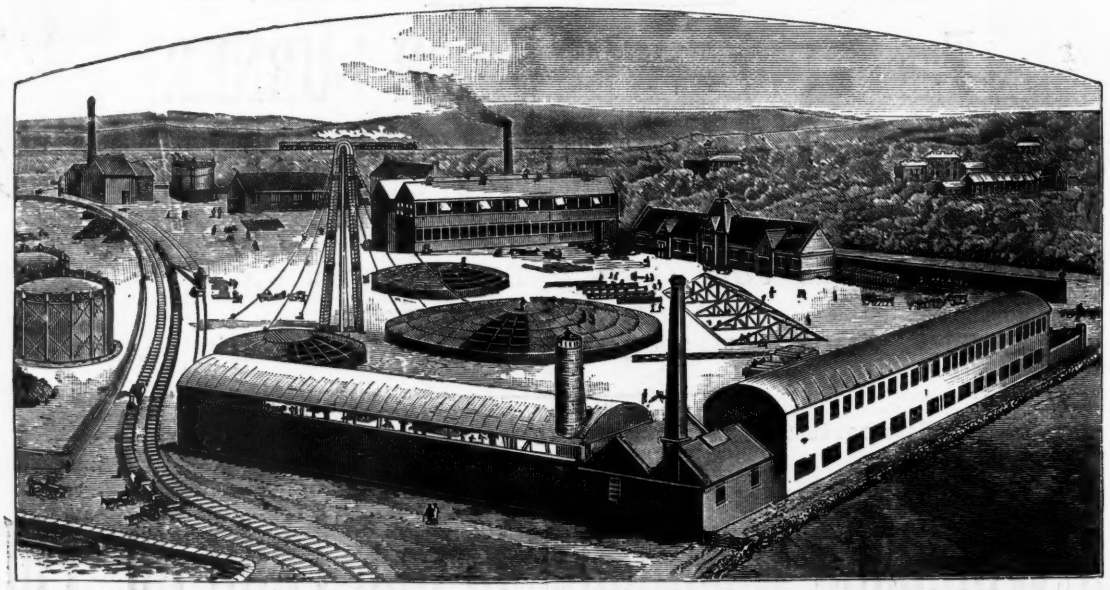

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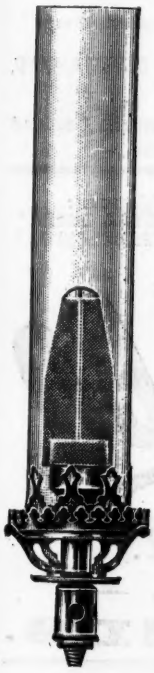

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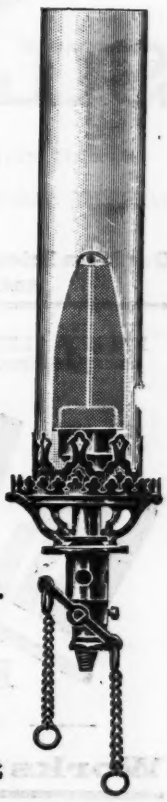

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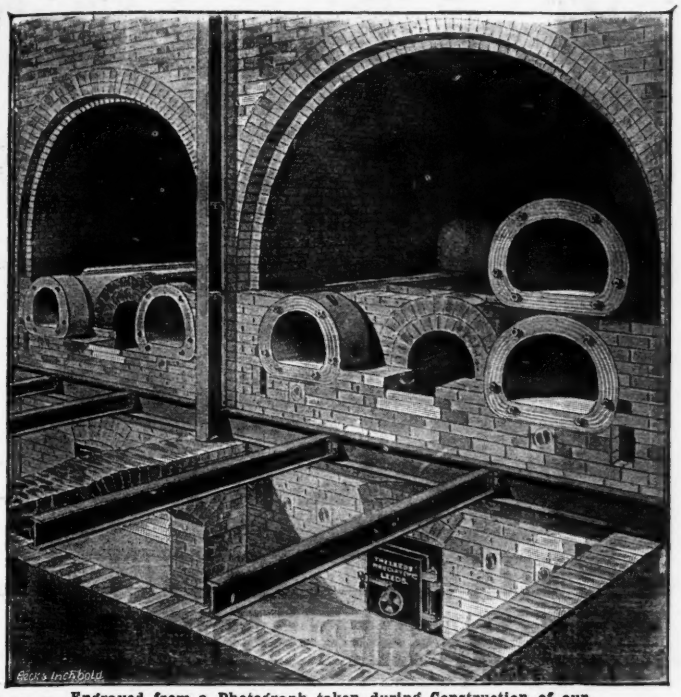

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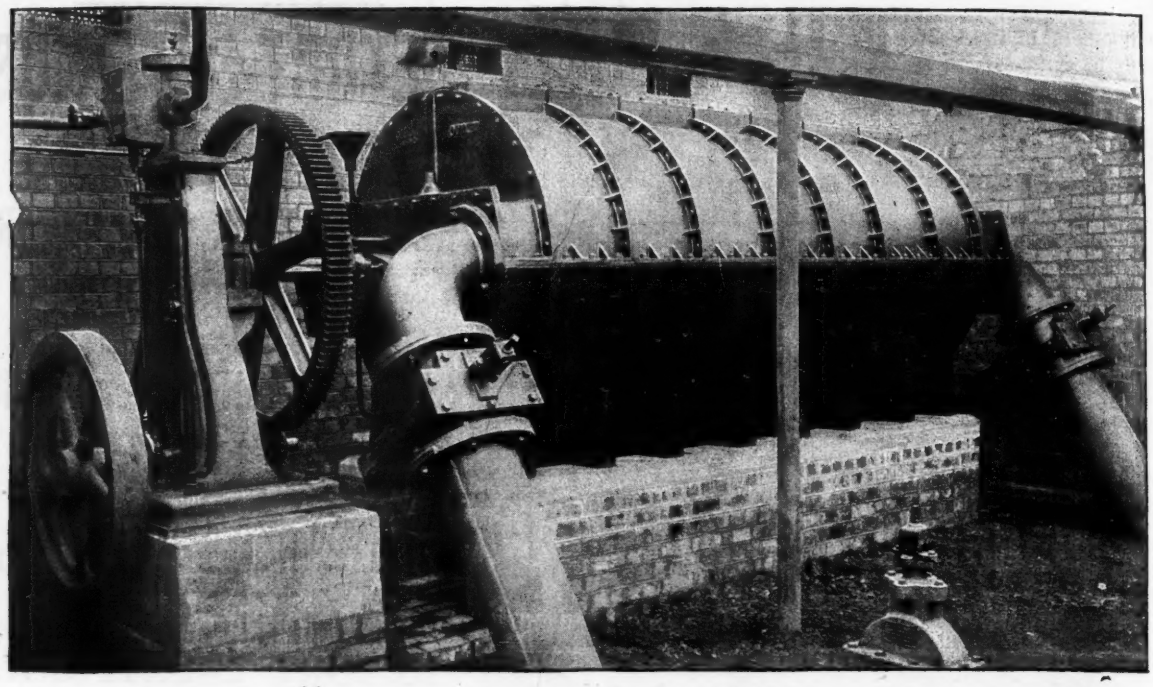

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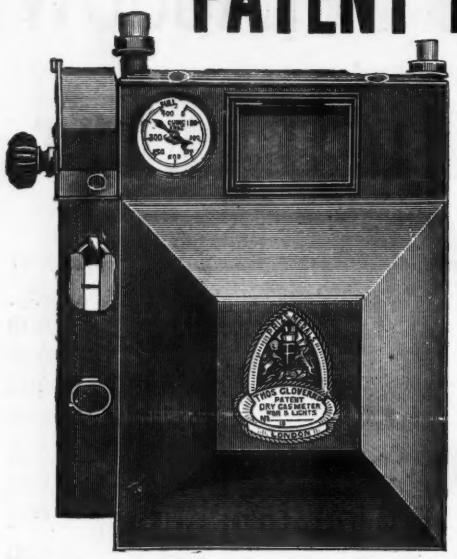

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EDITORIAL NOTES.

An Abortive Libel Action.

THE heaviest libel action relating to the proceedings of a joint-stock company promoter to occupy the attention of a Judge and a Special Jury since the lawsuit between Mr. Samson Fox and "To-Day," was that of Sir Joseph Savory, an ex-Lord Mayor of London, against the journal "London," which ended last Friday in a verdict for the defendants, with costs. The difference between the findings of the Juries in these two cases illustrates the working of the mysterious influence called "public opinion." Our readers do not need to be reminded of the character of the company-mongering performances of Samson Fox; and we are not going to recapitulate the course of the consequent events, which ended in the proprietors of "To-Day" having to pay some thousands of pounds in costs for damaging this person's reputation to the extent of one farthing by their exposure of his dealings. But since then, the Lord Chief Justice of England and other prominent people have raised a mighty outcry against the evils of the joint-stock company system, and particularly against the abuses of company promotion. Consequently, the newspaper-reading classes of the community—especially those who habitually derive their opinions upon the topics of the day from the best journals—have insensibly been led to look at company promoting from a different standpoint than that which members of their own class commonly took even a couple of years ago. The sporting view of company speculations has given place (perhaps only for the time being) to the high moral judgment that condemns gambling even in stocks and shares.

Special Jurors are representatives of the class most susceptible to these changes of public opinion; and their verdicts are apt to register them with a fidelity which is embarrassing to the parties who are called upon to pay for the operation. In the present case, there is no doubt that Sir Joseph Savory has been made a scapegoat for bearing the sins of the City, under the lash of "Progressive" journalism as represented by "London." Into the independence and probity in all respects of this periodical itself it is beyond the present question to inquire. The point is that in recounting the history of the transactions that eventuated in the formation of the City of London Electric Lighting Company, it exhibited the action of Sir Joseph Savory, then Lord Mayor, in a scandalous light. He and his associates in the City Government were accused of having made private gain out of a business transaction over which, as members of the Local Authority, they had control. He regarded the accusation as libellous, and sought his legal remedy, which he has failed to obtain. It is not for us to compare the conduct of Lord Mayor Savory with that of Samson Fox; but we do say that if "London" deserves to be congratulated, then "To-Day" is to be pitied.

The facts of the case are few. From the first introduction of electric lighting on a commercial scale into the streets of the City, which was a temporary display of the quality of the light itself, with no reference to permanent business, the Corporation endeavoured to obtain the service upon an enduring basis. Nobody was willing to touch it; and the City had no prospect of placing its proffered contracts for electric street lighting until 1890, when three contracts, for as many City districts, were taken up by the Brush Company and Messrs. Laing, Wharton, and Down. The truth of the matter is that the method of putting the supply out by contract was a wrong principle, as was the carving of the square mile of the City area into three distinct districts. The business ought to have been done in the ordinary parliamentary manner, like the lighting of the rest of the Metropolis; but the Corporation doubtless acted for the best according to their lights at the time, and by the advice of their officers. The nominal contractors were unable to find the money required for meeting their engagements; and a special Company, called the "Pioneer" City of London Electric Lighting Company, was formed, with the Lord Mayor as Chairman, to finance the whole business, which was done by lumping all the contracts into one. Finally, the present City of London Company emerged from these dealings, with a capital swollen by the financial operations in which the Lord Mayor took part, together with a numerous selection of his relatives. Sir Joseph Savory's participation in these proceedings was characterized as "indiscreet" by the Judge; and he has been

punished for it. Little as we are ordinarily disposed to favour "London," or its municipal politics, we must rejoice, in the public interest, that the recounting of a true story such as that of the jobbing of the City of London electric lighting contracts has been found fair matter of newspaper comment. The tale is not a nice one; and the "moral" is certain to be preached for all it is worth. But almost worse than the original scandal is the canting Phariseeism of those commentators who never fail to try to make Party capital out of such regrettable incidents.

How to Get Papers for Society Meetings.

THE wail of the secretary of the technical society over the scarcity of "papers" has become so grievous in the land that something will have to be done to quell it, even at the cost of some coercive enactment. It is well understood that, without "papers," technical and professional societies cannot long continue in prosperity. When an organization of the kind is projected, be it a District Association of Gas Managers or any other agency for bringing together men having some common interest, those who consent to become members are supposed to engage themselves thereby not only to attend the meetings as regularly as possible, but also to do whatsoever in them lies to render them both useful and attractive. In course of time, however, the majority of members get into the habit of attending the meetings without the smallest intention of contributing to the transactions. The secretary passes his time between whiles in a peculiar variety of "paper chase" which is not at all amusing; and very often this proves fruitless. Even worse is the lot of the society which is driven to accept any sort of paper offered to it, in despair of getting something worth having. In these circumstances, attention may be directed to a rule of the Architectural Association—an organization which we have often remarked for the high quality of the papers usually forthcoming at its fortnightly meetings, which are regularly reported in the "Builder." It transpired, in connection with a recent admirable disquisition by a member, Mr. Paul Waterhouse, on the interesting subject of "Oriel and Bay Windows," that membership of the Association implies a willingness to contribute a paper, at the request of the Committee, upon a subject *selected by them*. Excellent idea! Mr. Waterhouse characterized the rule as an "unusually humane" one; and most professional men will agree with him. As he says: "The ordinary untempered request for a paper "brings with it a double horror, for with the honourable "burden itself there comes the duty of selection—a duty "which, as the paper writer passes in review the possible "titles of possible essays, so fills him with the sense of his "own ignorance that the process of choice becomes merely "a process of rejection, followed eventually by recourse "(or shall I say relapse?) into some faltering selection of a "theme where for the moment the mist of nescience seems "to hang less thickly than over the surrounding regions." Indeed, the more the device is looked at, the more attractive it appears. It is essentially, as Mr. Waterhouse avers, a kindly course. A subject and a man are mated; and, for better or for worse, are they afterwards introduced to one another. It saves a world of trouble, besides being the means of interesting a large number of middle-aged practitioners in subjects of which they had previously no knowledge whatever. For the writer who is faced by an unresponsive title naturally goes straight to the text-books, and afterwards to the works, or even to the Patent Office abstracts of specifications, and straightway finds himself in a new world.

A vast amount of pertinent comment and reflection might be tacked on to this rule, which would go to show that it is, after all, the way of the workaday world in science, literature, and industry. How does the busy journalist keep up his voluminous output—writing "papers" day after day upon all sorts of subjects; while the average member of a technical society protests his want of time and ability to compose one professional paper a year? Simply because the journalist's subjects are, as a rule, dictated to him by the passing events of the day. The possible writer of professional papers who is not a regular scribe for the Press, really suffers because he waits for some special inspiration. He is attempting to live with the essayists of the period of the old "Spectator," when cultured gentlemen sat down in wigs and ruffles to express elegantly their views of Friendship, Envy, and similarly abstract topics. They could tell their equally leisured readers with approbation, that "Courage is a habit of the Mind, Forti-"tude an effort of the Will," and so forth. We have long passed all that; and the modern writer of essays has to handle subjects which he must illuminate there and then, or stand aside. Something of the same strenuous suggestion must be brought to bear for the production of professional papers. The Architectural Association have one way of accomplishing this object; and it is an expedient well worth extended trial. Some tact, doubtless, would be needed in applying so new a regimen to the members of an aged society; but if it could be shown to be a matter of life or death for the organization, the experiment would probably be sanctioned.

Water Gas and the Size of Domestic Fittings.

SURPRISE seems to have been occasioned at Plymouth by the announcement that the consumption of gas is not increasing. It certainly is surprising. If there is among the larger, as distinct from the largest, towns one which appears to be growing more rapidly than another, it is Plymouth. Besides, gas is exceptionally cheap there; and in addition, a gratifying amount of success has attended recent efforts to popularize its use by means of automatic meters and the hire of cooking-stoves. Since the Gas Company took up this business in June last, in conjunction with Messrs. Richmond and Co. and Messrs. Willey and Co., some 1200 automatic meters and cookers have been fixed, and 700 larger cooking-stoves have been lent on hire. With a knowledge of this fact, a local paper suggested, when complaints were made of "the bad gas" in certain parts of the town, that an explanation might be found in a growth in the demand for gas which had overtaken the means of distribution; and the Gas Company were advised to lay larger mains. On subsequent inquiry, the newspaper was led to modify this opinion. It ascertained that, despite the great activity in the stove and meter department, the consumption of gas in the September quarter was actually less than in the same quarter of last year. Three possible explanations were put forward to account for this phenomenon. One was that the weather of the past summer was very fine, which is true, but unconvincing. Another, that there is a greater use of incandescent burners, which also is true, but appears insufficient to counteract the effect of the increased consumption of gas for cooking. Finally, it is suggested that less gas was consumed because the "blend" of coal gas and carburetted water gas now supplied is of heavier specific gravity than the coal gas formerly sent out. In other words, the people there do not use so much gas because, with the same fittings, it is impossible for them to get as much as they had when coal gas alone was supplied.

It is obvious that this opens up a large question. The explanation of the officials of the Gas Company as to the want of pressure of which their customers complain, is that the gas they are now supplying necessitates a larger area of pipes and burners. In connection with the penny-in-the-slot meters, where the Company supply free fittings, they are fixing No. 7 Bray's flat-flame burners; and the ordinary consumers are advised to do the same, or at least to put in larger burners, if not also larger meters. It is difficult to imagine what will be the effect of such advice upon the thousands of customers of the Company; while the brain positively reels at the prospect of all the gas consumers in every town in which water gas is in use adopting the advice to give attention to their fittings, and put in larger burners. Nevertheless, it is a subject which will demand attention if the theories put forward at Plymouth, as to the influence of the greater density of water gas upon the supply in individual cases, are established.

The Malvern Link Award.

IN the Malvern Link gas arbitration, the proceedings in which were reported in the "JOURNAL" for the 8th ult., the Umpire (Mr. J. Shiress Will, Q.C.) has awarded the Gas Company £22,100 for their undertaking. The claim was for £25,457; and the valuers for the purchasing authority thought £18,462 the proper figure. The award, therefore, appears to very fairly strike the mean between these valuations. Of course, the costs of the arbitration must be added to this figure. It will be remembered that the Umpire granted a special case for the ascertainment of the law upon a point raised at the suggestion of the District Council. This referred to the question whether by absorbing the district for administrative purposes the District Council had *ipso facto*

acquired powers to compete with the Gas Company. It is understood that the Umpire's award takes no account of this point; and it is reported that the Council intend to appeal on the point of law. As remarked on the previous occasion of our noticing this arbitration, the point is a regular attorney's quibble. As to whether it is sustainable or not, we cannot presume to say; but there is no harm in expressing the opinion that if they get the Link gas undertaking for the value assigned by Mr. Shiress Will, the Malvern Council will have a good property at a fair price. If they can knock it down to an old-iron value, they will not benefit the ratepayers in the long run one iota; while downright robbery will be inflicted upon a number of honest people who have done no harm. This may be law; but it would be very poor justice.

Peddling Ironmongers at Southport.

It was remarked a short time ago in these columns that, according to their trade journal, tradesmen of the ironmonger kind entertain special views of their rights as regards competition by other shopkeepers. Yet another illustration of the same arrogance comes from the same source. From a recent number of the "Ironmonger," we learn that two or three years ago the Southport Town Council decided, at the suggestion of "a certain councillor," with a view to extending the use of gas, to supply gas for cooking and heating purposes at 6d. per 1000 cubic feet less than the rate for lighting, and also to fix all stoves free of charge. Several thousand gas-stoves were accordingly fixed gratuitously in the town, "which meant a great loss "to the ironmongers, many of whom are also plumbers." How the creation of a line of business which did not previously exist can be truthfully described as a loss to anybody, our contemporary must be left to explain. Mark, however, the swiftness with which retribution came upon this outrager of the sacred rights of the "trade"! The profits of the Municipal Gas Department last year showed a certain falling off, owing to the fact that the heating and cooking gas hardly paid for itself at the reduced rate. "One of the town councillors chiefly instrumental in carry-"ing the free gas-stove-fixing policy, offered himself for "re-election at the polls on Nov. 1. But the Southport "ironmongers rallied in their thousands to vote down the "free-fix man, who was defeated." More shame to the peddling shopkeepers who could display such spitefulness, with the object of punishing a public man for his vote on a public question. Is the town of Southport to be administered in the interest of its ironmongers? Truly, Local Option opens out a pleasing prospect of life in such provincial communities, where every trade is to have its own way. If anybody requires an illustration of what is meant by Provincialism, here it is. The "Ironmonger" is published in London, and might have been thought above supporting this paltry "tit-for-tat" parochialism. We hope the day will be far distant—in Southport or in any other English town—when town councillors will be deterred from doing what they regard as right and politic in the way of popularizing a public service, through fear of a sordid combination of small shopkeepers groaning over the "loss" of what was never theirs.

Mr. J. Fletcher Moulton and the Abuses of the Patent Law.

Speaking at the last monthly dinner of the Article Club, Mr. J. Fletcher Moulton, Q.C., gave the company the benefit of some of his opinions respecting the working of the British Patent Law. He mentioned first an abuse of the law of patents which is already a great nuisance to the commercial community, and appears to be rapidly growing—the terrorizing of the trading public by infringement notices. This is a quite modern, and altogether unlovely, excrescence upon our patent system. Time was when the holders of patent rights were content to do their own detective work; but now, in many instances, they prefer to cry out long before they are hurt, and breathe, by the agency of advertisement, threats of what they will do if ever they find themselves injured. This line of conduct is distinctly to the prejudice and limitation of commerce; and sooner or later somebody will have to smart for it. It is quite legitimate for patentees who have made good their property in the Courts, at considerable expense, to publish the fact far and wide, and take every legitimate means of securing the fruits of their pains and outlay. But when people who have never justified their own claims threaten others with what they mean to do, it is a pernicious piece of interference with trade. Mr. Moulton thinks that the Courts should have power to make sensible arrangements between parties in patent actions, after the rights had been settled. What seems to be even a more pressing need is that, when any parties threaten proceedings of the kind we have mentioned, they should be compelled to be as good as their word. The law punishes a shopkeeper for endeavouring to recover his accounts by issuing a colourable imitation of a "lawyer's letter." It should be possible to bring to book those who wilfully hamper trade by pretending to have "master patents," and trying to frighten everybody with them. Let such claimants bring their action, and get their lawful remedy at the earliest possible moment, if they can; but meanwhile it must do even their own interest an injury to warn the public away from touching the thing which may some time be found to be the subject of a patent. As regards the question of compulsory licences, Mr. Moulton expressed himself with much reserve. He thinks that the determination of what constitutes the use or abuse of a patent should be left to a Jury; for the reason that if the Judges have to decide such questions, they will be inclined to lay down hard-and-fast rules for their own guidance, whereas a Jury would settle every case upon the facts. Lord Justice Vaughan Williams agrees with this view of the matter. It is satisfactory to learn that Mr. Moulton has not much fault to find with the Patent Law of this country. It is what is done outside the law, although in the shadow of its name, that most troubles the commercial world.

WATER AND SANITARY AFFAIRS.

In furtherance of the policy adopted by the London County Council on the subject of the Metropolitan Water Supply, it is not sufficient to have it proved in evidence before the Royal Commission that a supply of water must be introduced from Wales some thirty years hence. Still less will it answer the Council's purpose for it to be shown that the present sources will be adequate up to a date yet farther on. At the sitting of the Commission last week, Mr. Balfour Browne, Q.C., referred to the evidence given by Mr. R. E. Middleton as having "gone beyond the Balfour report," by showing that the present sources of water would meet all requirements for years beyond 1931. "I want to break "that down," said the learned Counsel. The object of this was clear; the Chairman of the Commission having previously remarked, "If you satisfy us that it is necessary to "go to Wales"—speaking in the present tense—"it will be "an argument against the Water Companies, because it "will entail a much larger expenditure on the purchaser, and "so reduce the price to be paid." The urgency of the case must be proved; for the farther off the crisis is put, the less effect will it have on the current transaction. If it be clearly seen that water must be brought from Wales even fifty years hence, it may tend in a certain degree to influence purchase at the present date; but the effect would be slight compared with showing that the need is so pressing as to render it necessary for huge constructive works to be taken in hand as soon as an Act of Parliament can be obtained. Without admitting that even an early extension would warrant any discount on the value of the existing undertakings, it is quite palpable that the Council indulge in the expectation that this would be the case. Hence the Welsh scheme is made a present-day affair, and the existing sources are described as already failing. "Mr. "Middleton will have to anticipate 1931 by a very much "earlier date," says Mr. Balfour Browne, who argues that, in order to provide the requisite supply, there will have to be a large expenditure before that year. As if in discredit of the County Council tactics, Lord Llandaff observed respecting this contingency: "That will not diminish the "cost of purchasing the Companies as they at present "stand." Unquestionably the Council hope to produce such a result; and the manner in which they have now approached the Commission shows distinctly—though it simply conforms to what has been seen before—that the Welsh scheme is intended to depreciate the value of the works that have been already established. At one time, in the course of last week's meeting, Lord Llandaff appeared to be getting into a difficulty as to the functions of the Commission. Addressing Mr. Balfour Browne, his Lordship asked him to remember that the Commissioners had

nothing to do with deciding whether the Thames and Lea were really capable of affording a sufficient supply. In an engineering sense this is true; but in a financial sense the case is otherwise. If present sources are insufficient, a large outlay must be incurred for a supplemental supply; and this enters into the question which Lord Llandaff says forms the "business" of the Commission—namely: "Is it "financially expedient to purchase?" In dealing with this topic, Lord Llandaff makes the admission: "We must "take into account the probable cost and the probable "future expenditure of the purchaser."

Should the present Commission decide that London has at its command a sufficient supply of water for a period quite as remote as that calculated upon by Lord Balfour's Commission, or even farther away, the question of purchase may still be entertained, but will present a very different aspect from that which the County Council seek to give it. Already the East London difficulty is disappearing; and to-morrow the constant supply will have been rendered complete over the entire area of the Company's district. Thus the four hours' supply becomes a thing of the past; and the arrangements which are being made preclude the possibility of such a restriction being repeated. It is a singular fact—to which we have already made some reference—that if the constant supply had never been introduced, the "water famine" of East London would never have been heard of. A supply flowing for four hours into house cisterns would have satisfied everybody. Such a supply exists in the City, and has so existed for years, not only in warehouses but in dwellings; and no discomfort has been experienced. But the constant service once attempted has to be continued; and we fear it is not possible to re-introduce house cisterns where they have already been abandoned. A better system may perhaps be enforced where houses have yet to be built; but, as a general rule, the consumer must consider his own risk, and endeavour to control his landlord. With the constant supply in operation, the subject is likely to be forgotten. The County Council have now lost their chance of buying up the East London Company at a reduction as a Company in "default." The Hackney Vestry have taken up the question in the hope of enforcing penalties and distinguishing themselves, and have appealed against the decision of the Registrar of the Railway and Canal Commission, who disallowed their 500 or 600 interrogatories, arranged in 34 sections. Hearing the appeal last week, the Commissioners decided on striking out some of the interrogatories, and hearing further what Counsel had to say on the subject. The entire proceeding of the Hackney Vestry seems of a fussy and contentious character, such as may serve to harass the Company without effecting any public good.

The Earl of Onslow's figures respecting the cost of carrying out the County Council schemes for dealing with the Metropolitan Water Supply have been challenged by "Ratepayer" in a letter to "The Times" last Saturday. In this letter, the income of the Water Companies is put at £925,236 per annum; this sum being arrived at by taking the average of the three years ending with 1896-7. Lord Onslow's estimate of £990,000 is described as "nearly "right." It is so "nearly" correct as to be only about £7000 more than the actual income of the Companies in 1896-7, as stated by "Ratepayer." But we can come to a later date, fairly representing the present time, as shown by the last issue of Mr. Lass's "Analysis," where the net profits of the Companies for the year 1897-8 will be found to be as much as £1,037,998. Assuming that the County Council have to buy the undertakings, the question is entertained as to what they are worth. "Ratepayer" says: "In 1891 the Council had been advised, and began "to recognize, that this income was incapable of much "expansion, and liable to great reduction." As a matter of fact, since 1891-2, the net profits of the London Water Companies have risen at the average rate of £19,000 per annum, and during the last two years the rise has exceeded £98,000 per annum. Fluctuations of income have occurred, and 1895-6 exhibited an exceptionally low amount; thus serving "Ratepayer's" purpose as creating a reduced average for the three years of which it formed the centre. But the increase since that period has exceeded £197,000—an enormous advance in two years. "Ratepayer" takes no note of this, and predicts that in the next ten years the net profits will be "obviously lessened" owing to the large outlay necessary to maintain a sufficient supply. With an increasing business, the owner has to enlarge his premises; and this, strange to say, is looked upon as decreasing the value of the concern!

In addition to the large increase of capital outlay, "Ratepayer" dwells on the probability that the Companies will have to bring down their charges to the level of the lowest; and he estimates that this would reduce the gross income from about £2,000,000 to £1,750,000. The gross income, we may just observe, is now £2,171,000. But the probability that Parliament would arbitrarily interfere to alter the rates already granted is fairly out of the reckoning, and forms no appreciable risk. To strengthen his case in foretelling evil days for the Water Companies, "Rate-"payer" intimates that "if the present offer of purchase "is rejected, a proposal of competition would be strongly "reinforced by public opinion." But a competitive scheme cannot be introduced for nothing; and "Ratepayer" may amuse himself by calculating how far such an undertaking would pay. The risk that more immediately presents itself with regard to this water controversy is that "Ratepayer," and all his class, will experience a reduction of their own net profits or personal income by an increase of rates. What the Welsh scheme will cost, and what benefit it will be to London, are matters which the special correspondent of "The Times" made very clear in that journal yesterday; and further emphasis is given to his statement by an editorial article. It is shown that the Welsh supply depends on storage, and would be far more costly than the works at Staines. The catchment area of the Thames, owing to its great extent, is demonstrated to be a more productive and trustworthy source of supply than the mountain rivers of Wales. The physical as well as the financial facts are clearly in favour of the Thames Valley as a source of supply for London. That Wales must be brought in as a supplement is as yet a remote contingency; and the conclusions of the Balfour Commission are fully vindicated by the statements now given—based on irrefragable data.

It will be seen by our "Legal Intelligence" that the Court of Appeal last week affirmed the principle on which the rating of reservoirs is based. Under one of the subsections of section 211 of the Public Health Act, 1875, certain classes of hereditaments—among them being "land "covered with water"—are to be rated at one-fourth of their net annual value. In the area under the jurisdiction of the Hampton Urban District Council are the works of the Southwark and Vauxhall Water-Works Company, one of whose reservoirs the Council rated at the full value. The Company resisted the claim, amounting to about £137; and they were accordingly summoned before the Justices at the Teddington Petty Sessions. In support of the claim it was contended that although the words of the Act would apply to an ordinary lake, they could scarcely do so to an artificial structure, consisting of embankments and a concrete bottom, the production of which had required engineering skill and had involved an immense outlay, and which was of the nature of a huge tank or vessel put down upon the land. On behalf of the Company, it was pointed out that a filter-bed, even when constructed upon arches, had been decided by the High Court to be "land "covered with water" for the purposes of rating; and that as these beds were only intermittently covered, reservoirs, which are permanently covered, should *a fortiori* come under this ruling. The Justices said they must decide the matter from a common-sense point of view; and they made an order for the payment of the amount claimed, but granted a case. This came before Justices Wright and Darling in the Queen's Bench Division early in the year, when the contention of the Council was ably supported by Sir E. Clarke, who argued that a reservoir held water in the same way that a gasholder held gas; and nobody would, he said, dream of calling a gasholder "land covered by gas." Their Lordships thought they were bound by previous cases, which could not without casuistry be distinguished from the one before them; and they decided in favour of the Company, but gave the Council leave to appeal. The matter came before the higher Court (consisting of Lords Justices A. L. Smith, Rigby, and Collins) last Thursday, when the decision of the Divisional Court was upheld. Lord Justice Smith said it seemed to him that, on the plain reading of the Act, a reservoir was "land covered with "water" within the meaning of the section cited. With regard to authorities, he pointed out that there were three cases decided on words identical with those in the section in question; and he expressed the opinion that

the cases under the Lighting and Watch Act relied upon by the Council were inapplicable to the consideration of the meaning of those words. This pronouncement settles definitely a matter which has probably been under consideration by other authorities than the one whose action has evoked it.

At the termination of his occupancy of the presidential chair of the British Association of Water-Works Engineers, Mr. W. Matthews, the Corporation Water Engineer of Southampton, will be able to take a retrospective glance at the year's work with considerable gratification. The Southampton meeting held last May left nothing to be desired; and the interim gathering at the Westminster Palace Hotel last Saturday possessed some of those features which give satisfaction to members who, at some little personal sacrifice, perhaps, attend on such occasions. The number of members present was good; and the list of members and associates was augmented by the admission of eight candidates. Among the new-comers is Mr. W. A. Valon, of Ramsgate; and the Association will without doubt be well rewarded, now that they have so far secured him, if they can prevail upon him to give them the benefit of his mature experience in the work of similar organizations. Touching this question of membership, while we have no official information that it is so, we believe that the Council are doing something towards repressing a growing desire on the part of representatives of trading firms to obtain entrance into the Society as associates. If this surmise is true, the Council are acting prudently. The Association was constituted solely for the elevation and dissemination of professional knowledge; and this laudable object should be jealously safeguarded, and not be permitted to be affected in any way by commercial influences. Some traders would deem it an unworthy action to avail themselves of their connection with an Association of this kind to advance their business interests; others would not. In further opening the door, therefore, there is danger.

The Association last Saturday adopted the judicious suggestion made by Mr. D. M. F. Gaskin at the last annual meeting, that Rules 30 and 31 should be amended, in order that the officials—the President in particular—who enter upon their duties at the annual meeting might be elected at the winter gathering. By the old procedure, the President was placed in the singular position of being elected only a few minutes before he had to deliver his Inaugural Address. Under such circumstances, with the address snugly reposing in his pocket, the submission of the President's name to the members, and their grave signification of approval, was nothing but an empty formality. The practice, too, might some day have been the means of precipitating a meeting into a perplexing predicament; but now all chance of such trouble has been averted. The new rule cannot come into operation until after the next annual meeting; but the Senior Vice-President is Mr. William Watts, of Sheffield, and his popularity assures his election. The only technical contribution to last Saturday's proceedings was a paper by Mr. H. Bertram Nichols on "Water Supply from the Lower Greensand at Leighton "Buzzard." The principal aim of the author was to show the steps that had been taken to remove the iron which is present in the town's supply in objectionable quantity. The paper was subjected to a searching criticism; but the absence of certain details, and the inability of the author to supply them off-hand, rendered an otherwise good discussion somewhat incomplete.

THE "ROBERT HUNTER FUND."

FIFTH LIST OF CONTRIBUTIONS.

	£	s	d
Amount already acknowledged	235	17	0
A. B.	5	0	0
Barton, Mr. John, Peterborough	1	0	0
Frith, Mr. J. R., Runcorn	1	1	0
Gas Lighting Improvement Company, Limited	2	2	0
Gas Meter Company, Limited	5	5	0
Gibbons, junr., B., Dudley	5	5	0
Lord, Mr. J. E. Calvert, Weaste	2	2	0
Russell and Sons, Messrs. James, Wednesbury, per Mr. Mark Bowden	1	1	0
Tooley, Mr. George, Leeds	1	1	0
Wrexham and Acton Collieries Company, Limited	5	5	0
Young, Mr. John, Norwich	1	1	0
	266	0	0

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1369.)

THINGS on the Stock Exchange last week were torpid. Decided symptoms of the approaching death of the year were apparent when old accounts should be wound up and a fresh start made, especially when the inevitable pinch for money just at the close of the year is past and gone. But though business was so quiet, prices are not uniformly down; and in the American market at least, there was a good steady advance. The Money Market remained easy and unruffled by the Continental demand; and short loans and discount rates alike have not hardened. Business in the Gas Market was much slacker than the preceding week. Not many changes in quotations were effected; and the prevailing tendency was very fairly firm, despite a few retrogressions here and there. But the best evidence that good Gas securities still stand well in the public estimation was afforded at the Mart on Tuesday, when The Gaslight and Coke Company had no difficulty in disposing of £187,500 ordinary stock, at an average of 111. Allowing for next February's dividend, this is equal to 283½ for Gaslight "A." In the Market, Gaslight "A" improved upon the strength it had shown at the close on the previous Saturday, and marked 290 more than once on Tuesday. But afterwards it eased off a little; and the closing marks were not equal to the best of the week. A fair amount was done in the secured issues; but the prices were not particularly good. South Metropolitan, which had lately been showing symptoms of giving way, fell back a point and a half; business being marked as low as 137½. There was nothing done in Commercials to notice. Rather more business occurred in Suburbans and Provincials, especially in British, which was offered at lower figures. Alliance and Dublin, however, had a rise. Transactions in the Continental group did not amount to much; all issues being quiet and steady, with quotations unchanged, except that Tuscan had a fall. Among the remoter undertakings, a slight relapse in River Plate was the only incident. Business in Water was of about its usual modest proportions. Southwark and Vauxhall had the lion's share of it, and scored a nice advance in quotation, in view of the next dividend being at the rate of 7½ per cent.

The daily operations were: Business in Gas was only moderate on the opening day; but prices were good, and quotations rose. Gaslight "A" gained 2; and Alliance and Dublin, ½. Tuesday was more lively, with bigger dealing in Gaslight "A," which was very firm. But South Metropolitan fell 1½; British and Tuscan, ½ each; and River Plate, ¼. In Water, Southwark ordinary rose 7; and ditto "D," 5. During the rest of the week, transactions were moderate every day, and without any specially noticeable characteristic. Quotations throughout remained unchanged, except that on Friday Chelsea Water debenture went 2 higher.

ELECTRIC LIGHTING MEMORANDA.

Sir Joseph Savory's Libel Action—Verdict for the Defendants.—The Prospects of the London Electrical Cab Company—Experience of the Company.

THE hearing of the libel action brought by Sir Joseph Savory, Bart., M.P., an ex-Lord Mayor of the City of London, against the proprietors of the journal "London," for damages for alleged libel, began in the Court of Queen's Bench last Wednesday, before Mr. Justice Day and a Special Jury. The cause of this litigation was given in the "JOURNAL" for July 5, in our "Electric Lighting Memoranda," to which we must refer our readers for information on the point. The alleged libel was of a most serious character; and Sir Joseph Savory claimed £10,000 damages in respect of it. He was charged with discreditable and sordid practices in connection with the promotion of the City of London Pioneer Electric Lighting Company. According to his Counsel (Sir Edward Clarke), the operations in question are properly describable in very different terms. Shortly stated, Sir Joseph Savory became Lord Mayor in November, 1890, when the contracts for the electric lighting of the three districts into which the City had been divided for the purpose were already definitely settled between the Sewers Commission, of which he had never been a member, and two electrical engineering firms—the Brush Company having two of the districts, and Messrs. Laing, Wharton, and Down the third. The Contractors, so it is stated, had not the means of carrying out their engagements; and it was repeatedly pressed upon Sir Joseph Savory when he became Lord Mayor that it was his duty to lend a helping hand in the work of getting the contracts fulfilled. He therefore assisted in floating a so-called Pioneer Company, with the comparatively small capital of £100,000, avowedly for the purpose of keeping the contracts alive and launching a larger Company with sufficient resources for carrying them out as one undertaking. The immediate objects of the Pioneer Company were attained; and the shareholders received their capital back with a bonus of 50 per cent.

In his cross-examination, Sir Joseph Savory was taken through the financial history of the various developments of the city of London electric lighting enterprise, which we must be excused

from following. Counsel for the defence appeared to be desirous of showing that the Pioneer Company was an unnecessary "go-between," largely composed of Sir Joseph Savory's relations and connections. The general contention by which this imputation was met was that at that period electricity supply from central stations was in its infancy; and, the Baring crisis occurring at the time, it would have been impossible to get money without this personal initiative of the then Lord Mayor. Evidence to the effect that the contracts were very favourable to the City was given by Major-General Webber, who settled the terms; by Mr. W. H. Preece, who advised the Sewers Commissioners on the contracts; by Mr. D. J. Ross, the Engineer to the Commissioners; and by others. Some piquant details respecting the electric light finance of the period were given in evidence by Mr. J. B. Braithwaite, jun. The severity of the judicial inquiry was accentuated by the defendants having pleaded justification; and, in the event, judgment was given for them with costs.

The ordinary general meeting of the London Electrical Cab Company was held last week, when accounts were presented which threw anything but a rosy light upon the cause of cab traction by accumulators. The accounts showed a debit balance to profit and loss of £6207. After all the glowing promises held out to the investing public when the Company started, it comes like the echo of an old familiar story to learn from the Directors' report that electricity proved excessively dear to buy, while the maintenance of the accumulators and the cost of renewals of rubber-tires have caused much anxiety and expense. So little did the existing Electricity Supply Companies appreciate the expediency of providing the cabs with electricity upon cheap terms, as a bit of "day load," that the Cab Company have been compelled to generate their own. In this confession there is a good deal more than meets the eye. We are surprised that our electrical contemporaries have not pounced upon it as an illustration of what electricity supply for general purposes by lighting companies is in practice, as contrasted with the theory. Over and over again the world is assured that only a sufficient day load is wanted, to keep the wheels going round regularly at the electric lighting station, for the cost of the unit to be greatly reduced to the public. Nay, such is the sanguine temperament of some electricians, that they even presume to treat the requisite day load as already secured, when they desire to "estimate" the cost of electric lighting "in the future." Well, here is an instance of one commercial Company treating with another for a daylight supply of electricity upon terms meant to be mutually advantageous; and the parties cannot agree to work together for a year. We are not disposed to apportion the blame for the rupture between the two Companies; but the Chairman of the Cab Company let fall some significant hints on the subject. His Company had agreed upon what looked like an advantageous price for their current; but "owing to only being able to obtain it during prescribed hours," and other drawbacks, the actual cost came out very different from the nominal price. This is the "day load" difficulty in a nutshell. In summer time, through the long days, an electric lighting company will be willing to do any amount of daylight work; but as the winter draws in, the overlapping of the night and day demands becomes a nuisance, and the latter has to go by the board.

By manufacturing their own electricity, the Electrical Cab Company expect to realize a saving of £50 a week, which surely means a good deal of day load gone astray from somewhere. In other respects, the experience of the Company is full of teaching for all those who are interested in a carrying or hauling speculation—not excepting gas-power tramcars. As the Chairman of the Company very pertinently observed, it is easy to point in the case of a pioneer undertaking from the prospectus to the balance-sheet. The stumbling-block of the Company was the absence of sufficient experience of working any vehicle like their own regularly for 50 miles a day. There is all the difference in the world between trial trips and the regular hack work. "It is this running regularly 50 miles a day which develops the weak points, such as tyres, which no amount of foresight could have prevented." If it were not tyres, it would be something else that would behave differently in regular use from anything expected from a trial trip success. The Company's prospectus promised a yearly profit of £38,446 from the running of 320 hackney cabs. The number placed upon the streets of London has so far been only 71; and this is quite enough, seeing how much has needed to be done to keep them going. It is scarcely a cause for congratulation that the newer cabs are admitted to be less comfortable to ride in than the old; while the newest driving-chains make more noise than the old ones, which were too weak. Altogether, the experience of the Electrical Cab Company will not silence the croakers who deny that electric traction by accumulators has any prospects of becoming lastingly successful.

Professor Lewes on Acetylene.—At the Society of Arts last night, Professor Lewes gave his concluding Cantor lecture on "Acetylene." Having on the preceding Monday shown how acetylene gas is generated and purified for domestic consumption, he proceeded to deal with its consumption for lighting, heating, and motive power, and with the application of acetylene in a diluted form. In these lectures Professor Lewes has thoroughly maintained his well-established reputation.

MECHANICAL TRAMWAY TRACTION.

CONCLUDING ARTICLE.

WE have now reached the point of being able to discern the true elements of the *permanent* solution of the problem of mechanical tramway traction. We italicize the word permanent, because it is the chief consideration in regard to the case of the London tramways. Curiously enough, it does not seem to have been so regarded by our electrical contemporaries, or even by some of the British municipalities who have ventured upon systems of electric traction. The "Electrician" remarks, upon Mr. Baker's report, that "if pretty pictures count for anything, the report should induce the Committee [of the London County Council] to prefer a conduit system; but nevertheless we incline to believe that when they see the prices they would have to pay for conduits, the ever public-spirited London County Council will advocate the trolley system after all." This is a small, short-sighted, and unworthy view of the question. London does not want the cheapest system of tramway working, but the best. Neither does the Metropolis provide an opening for an admittedly imperfect and transitional system which New York has rejected, and which all the most enlightened of European cities will only endure on their outskirts.

The electricians are never weary of reiterating that it is the overhead trolley-wire system of electric traction that has so far made most progress in the United Kingdom; and they point to Leeds, Bristol, Halifax, Dublin, Glasgow, and other places as examples of the reconciliation of British town populations to the drawbacks of the system, for the sake of its convenience as a means of transit. Such examples prove nothing beyond the local result, whatever it may be, because they have all been carefully designed to avoid the greatest difficulties inherent in the system. There is a type of mechanical maniac known to science, who is obsessed with the quest for "perpetual motion." Sometimes he cheats himself into the fond belief that he has succeeded, by making his machine work upon a knife-edge bearing in an agate cup. He thus reduces the friction to the smallest quantity, and thinks it has vanished altogether. This is his mistake. Instead of diminishing the ultimate obstacle to be overcome, the wise man would even exaggerate it, according to the sound philosophical rule that principles are to be tested by their most extreme applications. Those municipalities who have adopted the overhead trolley system of tramway working have followed the safe course of running it out into the suburbs. The electricians who have advocated the introduction of the system into England have fallen into the same weakness. They have described how successful it has proved in the United States, and how little of an eyesore in the most populous places, and have then suggested a trial in some outlying region. In the Glasgow instance, the line starts from near the centre of the city; but it soon gets away, and there are no crossings to negotiate. We would ask: Do the Corporation of Glasgow feel that the same system can be indefinitely extended throughout the centre of the city, as well as into the suburbs? It is in the former situation that the abolition of horse haulage would prove most beneficial, and the presence of the trolley wires most objectionable. Sooner or later, these are the localities which will determine the future of the trolley-wire system. In the case of London, they occupy the forefront of the situation. It is known what the trolley-wire system can do for long stretches of suburban roads; but whosoever would undertake to tackle the problem of Metropolitan tramway working must face, say, the line from Greenwich to Westminster Bridge, and all the cross lines at St. George's Circus and the Elephant and Castle. Half-measures are no good here.

It is only necessary to realize the force of the expression with which the present article commences—the argument for a *permanent* solution of the problem—and consider it as applying to the great centres of Metropolitan tramway traffic, to form the judgment that if electric traction means the trolley wire, the prospects of its complete adoption for London are hopeless. It is not the æsthetic objection that has most weight here. There are plenty of other crying reasons against the suggestion. It would unduly extend this essay if we were to follow Mr. Baker through his catalogue of drawbacks of the system; and therefore we will proceed to consider the only other system of electric traction for tramways remaining to be noticed—that in which the line conductor is carried in an underground conduit under or alongside the track. The chief objection to this method of conveying the necessary energy to the travelling cars is the expense of construction. Everything else, it is expedient to repeat, remains the same for the underground or overhead wire systems. There is the small objection that, with an underground conduit system, there is a longitudinal slot the more in the roadway; but this consideration cannot, with care, spoil the road more than do the tram-rails.

The most weighty argument for the underground conduit system is that it has superseded the trolley wire in New York and Washington, for precisely the same reasons that must operate in the selection of a system of mechanical tramway traction to permanently satisfy Metropolitan conditions. So long as there is sufficient traffic, the first cost of construction is of no importance in a tramway undertaking. Mr. Baker has just supplemented his report with an appendix,

consisting of a reprint from the New York "Street Railway Journal," of a most important disclosure of the traffic and working returns of the Metropolitan Street Railway Company of New York City, which amply proves the truth of this assertion. It should be remembered that this Tramway Company have run through the string of experiences of horse, cable, and underground electric haulage. They wished at one time to obtain permission to instal the overhead trolley wire; but this was denied, owing to the fixed determination of the Municipality to do away with overhead wires of every kind. Now the Company are glad they were prevented from taking up with a mediocre system, which would probably have militated against their changing again even for the best. They are able to compare horse, cable, and electric traction under identical conditions of management, and practically the same general circumstances. The administration has no prejudices in regard to any system. It is remarked that electric traction is harder on the rails than any other, by reason of the great weight of the cars and the grinding action of the driving wheels. On the other hand, the superior speed of the electric car reduces the mileage charges considerably. The net result for the past year gives the conclusion of the whole matter. The operating expenses of the cable lines were 16·42 cents per car-mile; of the horse lines, 17·87 cents; of electric lines, 10·23 cents. Assuming all things to be equal, this determines their choice. Stated in another way, the cable lines operated at 47·7 per cent. of their passenger receipts; the electric lines, at 37·9 per cent.; the horse lines, at 65·3 per cent. The Company, who control over 130 miles of track, are gradually converting their system to electric traction. Mr. Baker, in the covering letter of his appendix, states that "it is now proved beyond all controversy that the electric conduit system, besides its admitted advantages compared with the trolley, is not only electrically and mechanically satisfactory, but has shown results in economical working that have not been equalled by any other system." It is at least proved that there is no real reason why London should put up with the overhead trolley-wire system, if electric traction is to be adopted.

The fact remains, however, that the conversion of the Metropolitan tramways to any electrical system must be a very serious business. It means entirely relaying the lines, to begin with. So far as this part of the work is concerned, it will not make the smallest difference whether the electricity for working the cars is to be conveyed overhead or underground. The section of the Glasgow Corporation tramway relaid for electric traction has girder-rails weighing 100 lbs. per yard. The reconstruction is described in the "Electrical Review" for Oct. 21 and 28 last. The saving of cost to be effected by carrying the line conductor overhead instead of underground, is a question for the suburban sections of the Metropolitan lines. Curiously enough, we do not yet know how the underground conduit system would answer at big junctions and crossings, as the Elephant and Castle. We must be pardoned for so frequently mentioning this locality, as it constitutes the test of all possible systems of tramway working for London. Whatever answers here will answer anywhere.

Supposing the New York Company's achievement of 5d. per car-mile working expenses to be realized in London, it is obvious that the difference between this figure and the 10d. per car-mile given by Mr. Baker as the corresponding figure for London would not be all profit. A large proportion would be absorbed in repaying the cost of reconstruction and providing the new buildings and plant; and most of the balance would be intercepted by improvements and extensions of the service, and the reduction of fares. The public would want some compensation for the disturbance of the thoroughfares, in the form of cheaper travelling.

Many of the objections to electric traction are irrespective of the detail of the method of conveying the current along the line, over which the electrical interest raises such a pother. We have already alluded to the mechanical defect of the waste of power. How considerable this is, may be inferred from Mr. Baker's statement that an electric car usually carries two motors, each of 25-horse power. Fifty electro-mechanical horse-power to do the work, say, of a four-horse team! Of course, tramcars are usually hauled by a pair of horses; but double the number of hoofs to allow for the higher rate of speed, and still a huge discrepancy remains—to say nothing of the line and station losses. It will be said that all this disappears in the working returns. Doubtless true! The fact, however, remains that electric traction means enormous power generation at the stations.

Electric traction can only be had during stated hours. Whenever one looks into a matter of electricity supply, the "load factor" stares one in the face. Granted that electric traction is all that Mr. Baker's fancy paints it, for how many hours a day does he propose to keep the wheels going round; and what is to be done when the station is shut down? In this regard the electric tram compares best with the cable road. Both can handle any amount of traffic—the more the better. In the case of each, the costs of working begin to mount up with long intervals between the trips. The London County Council have already been approached on the subject of providing an all-night tram service. At least one of the suburban railways has conceded such a service. No system of transport that cannot be utilized at all hours in the same way can claim to be even approximately equal in convenience to a horse and cart.

The danger of electrolysis is the same whether the line conductor is carried overhead or in a conduit, because it is the leakage from the return lead that does the mischief. When the conversion of a tramway to electric traction is properly done, this evil may not be a very serious matter, although it must always necessitate the exercise of certain extra vigilance, of a new kind, by the proprietors of gas and water pipes within the danger area. What we wish to point out is that putting the line conductor underground at considerable expense, does not alter this question.

In conclusion, let it be said that the present opportunity seems specially made for the British Gas Traction Company to show what they can do with their gas-cars, say, upon the South London lines. There are gas-works in this region whence the necessary supply of compressed gas could easily be procured; and arrangements could be made for quietly putting a sufficient number of such cars in service to test the question of the suitability of the system under Metropolitan conditions. If the cars fail under this ordeal, we shall certainly not shrink from admitting the fact. So far as the British Gas Traction Company are concerned, it is "now or never" with them—a working service on the busiest London route, or a confession of failure.

CONFERENCE OF ITALIAN GAS MANAGERS.

At the meeting of the Société Technique du Gaz en France at Nice last April, the Committee appointed M. Godinet, of Lyons, to represent the Society at the congress of the Association of Italian Gas Managers to be held in Turin in the following June; also to visit the General Exhibition then being held in the city, and report on any matters of interest that might present themselves. He accordingly, accompanied by eleven other members who had received invitations, proceeded to Turin, where he received a cordial welcome from his Italian *confrères*. Their Society is by no means a newly-formed body—the last meeting being the twenty-seventh; nor is the number of members large. But there were about forty present at the various sittings, the proceedings at which, as well as at the social functions, which were graced by the presence of nearly as many ladies, were of an exceedingly pleasant character. M. Godinet returned highly gratified with his reception; and in a report which he has addressed to the President of his Society he gives an account of what he calls his agreeable and interesting mission. Some matters in this report may be briefly noticed.

The meeting extended over four days—from the 13th to the 16th of June; the technical business occupying three of them. Two important gas-works were visited—those of the Consumers' Company, of which M. Zina is the Engineer, and those of the Italian Company, which are under the direction of M. le baron Lucifero, a member of the French Society. One of the Turin Gas Companies invited the members to an excursion to Superga, with a luncheon, and the other gave them a banquet at the Exhibition; the two Companies uniting in arranging a farewell dinner at the Hôtel d'Angleterre. The rule with the Italian Society is that the oldest member shall preside at the meetings; but M. Roux, who, by virtue of seniority, should have occupied the chair, was unable to attend. His place was consequently supplied by M. le baron Lucifero and M. Zina; the secretarial duties being discharged by M. Krafft, Manager of the gas-works at Naples, and a member of the Société Technique. The sittings took place in the Board-room of the Consumers' Company.

With regard to the business, the first place in the programme was occupied by the subject of settings of inclined retorts. It was dealt with by M. Solanges, of Milan, and by M. Sospizio, of Trieste, both of whom have these settings in use, and therefore were able to give some working results. They expressed themselves as perfectly satisfied with the new arrangement, which, of course, requires fewer men. In Milan, the eight settings of nine retorts, 15 feet long, carbonize, at the ordinary working rate (six hours), 66 metric tons of coal per 24 hours with 14 men. In Trieste, the settings, though smaller than those at Milan, carbonize, in five charges per 24 hours, rather more than 19 cwt. of coal per retort; making for the six settings of nine retorts, 12 feet long, nearly 53 metric tons per 24 hours. M. Solanges exhibited a table containing the results obtained with inclined retorts at Geneva, Cassel, Vienna, Berlin, Brenton, and Dresden. It showed that the bulk of coal carbonized per man per day varies from 4·2 to 9 metric tons. The latter exceptional result is achieved in the gas-works at Brenton, where, in eight settings of nines, four men carbonize 36 tons in 12 hours. M. Godinet remarks that whoever furnished M. Solanges with his figures must have omitted to include a generator attendant, who is required just as much for inclined as for horizontal retorts. He questions whether the four men alluded to would have time and strength to do more than charge and draw. With five men, it would work out to 7·2 tons per man—a rather remarkable result, since with settings of horizontal retorts the quantity of coal carbonized per man rarely exceeds 2½ to 3 tons. According to the table referred to, the settings indicated give as an average 5¾ tons per man per day. The retort labour would consequently be reduced to the extent of 50 per cent. Further, the table showed that the 66 settings of nines dealt with carbonized altogether 624 tons of coal per 24 hours; being about 9½ tons per setting, or a little over 22 cwt. per retort. This would yield an average of 10,600 to 11,000 cubic feet of gas. But M. Godinet

points out that some of the settings cited are forced, whereas others are worked much more easily. Thus, at Geneva, doubtless during the trial-period, only 7·2 tons of coal were carbonized per setting; while in Berlin the quantity reached 12½ tons.

The power of settings of inclined retorts, therefore, varies considerably in different works. M. Godinet thinks there are two causes for this; the first being the length of the retorts, as it is evident that a retort 15 feet long is more powerful than one only 11 ft. 6 in. long. Then, as with horizontal retorts, apart from the temperature of the setting, there is the duration of the charge, the effect of which is very great. The table exhibited showed that six-hour charges give very inferior results to those obtained with four or five hour charges. In this case, 10 tons of coal were carbonized in 24 hours in settings of nine 11 ft. 6 in. retorts. M. Godinet regards all these trials as very interesting; and he thinks they should incite French gas engineers to seriously consider this essentially French question, which, curiously enough, as he points out, has been taken up and practically applied, not in France, but in other countries. Frenchmen are not altogether sure about the expense of keeping up these settings, whereas they know perfectly well that their first cost is high; and it is this that frightens them, not merely when it is a question of altering and extending existing works, but also when new ones or new settings have to be constructed. But he shows how easy it is to prove by figures that in large establishments where labour is dear the advantages of inclined retorts are very real ones.

While the subject of inclined retorts and the accessory appliances of carbonization was under discussion, M. Rouget gave an epitome of his communication to the French Society at Nice on the De Brouwer coal and coke conveyor, which was described and illustrated in the "JOURNAL" for June 21 last (p. 1469). This led to the consideration of the question of the mechanical storing of these two materials, though nothing new was brought out. The subject, however, in Italy as elsewhere, is engaging the attention of gas engineers. The programme would scarcely have been complete without some reference to water gas, and to the advantage that would accrue from the possession by gas companies of power to manufacture and distribute it. But it seems that, as in France, municipal authorities are fearful of extending the companies' privileges so as to include water gas as a branch of their business. M. Godinet regards this as being inimical to the interests of both suppliers and consumers. Carburation of gas is a subject which occupies the attention of Italian gas engineers. They would very much like to have the carburating materials freed to a large extent of the duty now imposed upon them, but without reducing the taxes upon petroleum, which are heavier than those levied in France, and hinder, or at all events restrict, the employment of this article. They have not yet found, beyond the Alps, the means of realizing this alluring dream. The consumption of gas was touched upon by M. Witmann, Manager of the Vesuvian Company at Naples, who introduced to the members the Greyson incandescent burner, which has been found to give such excellent results. A few remarks were made on the effects of electrolysis on gas-pipes and the precautions to be taken to prevent them. It appears that this trouble is less serious than it was feared it would be when the first electric lighting cables were laid; and M. Godinet suggests that this may possibly be due to the fact that the conductors are better insulated now than they were at the outset.

Legal questions affecting gas companies do not generally come up for discussion at gas managers' meetings; and, as far as the French Society is concerned, this is rendered unnecessary by the existence of a professional syndicate which deals with them. They, however, came to the front at the Italian meeting; and the cases cited are sufficiently curious to be briefly noticed. M. Witmann, whose name has been already mentioned, told his colleagues that one of the towns lighted by his Company would not pay the gas bill; and he thereupon applied to a Court of First Instance for power to attach the municipal revenues. The Court decided that it could not grant it. He then took the case to the Court of Appeal at Naples, which gave him authority to take possession of the town and its revenues. The authority was most rigorously exercised as far as the money was concerned, and even some of the furniture at the Mairie was seized. Finding itself treated in this unceremonious way, the town is seeking to have the judgment quashed by a higher tribunal. Such cases as this are rare in France; but M. Godinet fancies something similar has occurred in Spain, where, by virtue of a regal ordinance, a company was authorized to seize the revenues of a town. Another rather curious judgment was given at Milan by a tribunal somewhat analogous to the French Conseils de Prud' Hommes. It was delivered in favour of the Gas Company as the result of a complaint made by some of the stokers in their employ, who, when they saw the success of the Coze settings, refused to go on with their work on the ground that it was particularly hard, and even dangerous. An inquiry was ordered; and it was entrusted to workmen employed in other industries than that of gas supply. The effect of the judgment of this tribunal was to reject the stokers' demands, and to declare that with the new settings not only was the work less severe than with horizontal retorts, but that the Company had actually adopted arrangements to ensure the well-being of the men. At the same time, the referees came to the conclusion that the temperature in the vicinity of the upper ends of the retorts was rather high; and they made the Company undertake to carry out such a system of ventilation as would facilitate the work of the chargers.

The remainder of the report gives an account of the visits to works and to the Turin Exhibition. This may be left for notice on a future occasion.

PERSONAL.

Mr. UTRICK A. RITSON, Coalowner, of Newcastle, has been appointed a Director of the Newcastle and Gateshead Gas Company, in place of the late Mr. George Armstrong. Mr. Ritson is also a Director of the Newcastle and Gateshead Water Company.

It may be remembered that on the recent rather sudden death of Mr. W. J. MOTT, the Gas Manager to the Selby District Council, a fund on behalf of the widow and family was started by the Chairman (Mr. T. Liversedge) and two members of the Council, who each contributed £5 thereto. We learn that the fund is now closed, and that the total amount contributed was £73.

At the meeting of the Institution of Civil Engineers last Tuesday, it was announced that Mr. T. HOLGATE, of Halifax, and Mr. J. TIMMINS, of Wigan, had been transferred from the class of associate members to that of members. The first ballot for the present session resulted in the election of 15 members and 72 associate members. In the first-named class were Mr. T. J. BUSH, Engineer of the Australian Gaslight Company; Mr. W. F. COTTON, jun., of the Alliance and Dublin Consumers' Gas Company; and Mr. E. A. HARMAN, Gas Engineer to the Huddersfield Corporation. Among the associate members were Mr. J. HUSBAND, Engineer and Manager of the Brentford Gas Company, and Mr. W. S. M'GREGOR, Gas Engineer to the Longton Corporation.

NOTES.

Making the Heaviest and Strongest Concrete.

In the structural use of cement concrete, the requirement of lightness has been fairly satisfied by the employment of coke breeze for the bulk-material. It often happens that the very opposite quality, of extreme density and weight, is urgently required of the same material of construction. While the builder of fire-resisting houses wants to save all the weight he can, the engineer who wishes to obtain the heaviest possible bases for machinery objects to cement concrete as usually made, even of solid stone, on the score of its lightness. For breakwater work also, the lightness of cement concrete is a serious objection. Mr. James Christie, an American Engineer, suggests that this occasionally necessary quality of great weight and strength may be given to cement concrete by the expedient of mixing with it from one-third to one-half by weight of the whole mass, of iron turnings to which sal-ammoniac has been added at the rate of 1 lb. of the salt to 50 lbs. of iron. He says that this concrete will weigh 210 or 220 lbs. per cubic foot, and in one month will resist a crushing force of 3000 lbs. per square inch of surface, or six times the resistance of ordinary hard stone concrete. The experiment is worth further trial.

The Non-Porosity of Steel Plates.

One of the familiar myths of engineering relates to the alleged porosity of iron and steel under pressure, both to water and gases. Without pretending to deal with the subject generally, the facility of having heavy hydraulic power at disposal has enabled the Washington Navy Yard authorities to settle the question in a practical way as regards thin steel sheets. Accordingly, pieces of sheet steel of ¼ inch, ⅛ inch, $\frac{1}{16}$ inch, and $\frac{1}{32}$ inch thickness were subjected to a water pressure rising to 6000 lbs. per square inch; and percolation was never produced. Even a ⅜-inch rivet joining two ½-inch steel plates was found to be perfectly tight under the same pressure. These tests should help to dispose of some hoary old legends of water under high pressure being seen to spout in streams through solid metal. The same appliances were used to ascertain the friction of water under extremely high pressures; and it was found that there was no conclusive evidence forthcoming to show that the friction of water under high pressure is any greater than the friction of water not under pressure. It would appear to be evident, from experience with compressed gas cylinders, that gases cannot percolate through steel or wrought iron at practicable pressures.

The Newest Tests of Portland Cement.

The testing of portland cement, like many other operations of the kind, becomes modified in character from time to time. Not long ago the use of the "hot test" for cement was strongly advocated; and then it was contended that the admixture of sand with the cement was an indispensable preliminary to the attainment of results corresponding to actual working requirements. The very latest English views upon the subject are expressed by Mr. V. de Michele, in a recent letter to the "Engineer." The writer says that, following the German lead, it has become the practice of some English engineers to stipulate for the "sand test" of their cement. It appears, however, that this stipulation means practically the employment of a fine-ground cement. The finer the grinding of the cement, the better it stands the sand test. With this test, unfortunately, an additional element of error is unavoidably introduced; and for this reason

the majority of cement users have not entertained it. Mr. de Michele points out that, since fine grinding is the secret of success with sand tests, there is no necessity for using the sand in testing, as by the simple expedient of specifying the degree of fineness, coupled with the required tensile strength neat, more reliable results are obtained, and therefore better cement secured. The following test methods are advocated as adequate and conclusive. Gauge pats $\frac{1}{8}$ inch thick on glass, one to every three briquettes, to be immersed in water immediately, and left there for seven days, when they should be absolutely sound. Tensile strength of neat cement, 400 lbs. per square inch at seven days, 450 lbs. at fourteen days. The briquettes to be gauged by a skilled man, with the minimum quantity of water, well rammed into the moulds. The average of three breakages to be taken; the load being applied as quickly as possible. Fineness to be shown by residue not exceeding 15 per cent. upon a 100 sieve made of No. 42 S.W.G. wire, shaken for five minutes. This specification appears to be the last word in cement testing.

A Preventive for the Acidity of Smoky Fogs.

An interesting suggestion, which is novel to us, has been offered by the "Ironmonger," with the object of preventing some of the worst effects of town fogs—those due to the acidity of the chief components of the fog, the products of the combustion of sulphurous fuels. It is remarked that the soot and tarry matters of our town fogs, which come from coal smoke, make everything dirty, and are the source of much discomfort. The acid of the fog, however, is even worse. It irritates the eyes, nose, and mouth of those who are compelled to live in the foggy atmosphere; while it tarnishes all the ordinary metals, and hastens the rusting of iron and steel. Even in a private house, with all doors and windows shut, the effect of a bad fog is sufficiently marked. Articles become filthy to the touch, and nickel and silver goods are tinted all the colours of a (dirty) rainbow. The effect on bright iron and steel is usually permanent. To the question whether anything can be done to prevent the corrosive action of the fog acids, our contemporary answers that the presence of a little ammonia vapour in the air at such times is extremely "grateful and comforting." Both on the person and on metals the effect of ammonia vapour during a bad fog is stated to be beneficial. It is, at any rate, easily tried. All that is necessary to this end is to scatter, say, a teaspoonful of the "liquid ammonia" of the druggists on the floor, where it will mix with the natural air currents. Enough has been used if the air of the place distinctly smells of it; and the supply can be renewed at intervals as found necessary. The liquid is, of course, quite harmless. If preferred, however, the solid carbonate of ammonia placed about in saucers will answer the same purpose. It is an experiment that cannot possibly do any harm, and might do a certain amount of good. The suggestion will probably be carried out in a good many ironmongers' shops when the next dense fog threatens to spoil the stock.

Effect of Subsidence Due to Coal Workings.

The above subject, in its relation to bridges and other structures, was dealt with by Mr. S. R. Kay, at the meeting of the Institution of Civil Engineers on the 29th ult. The author showed that subsidence always follows coal working where no pillars are left; and it is generally proportionate to the thickness of material excavated. The depth regulates roughly the duration of the movement. Subsidence may be modified by tight packing of the goaf, where no coal is left for support under the area to be protected. Faults are responsible for much of the damage resulting from coal working. In their absence, natural breaks and joints in the strata, within the limits of the dynamic effect of the subsidence, form the lines of weakness. Fractures seldom find their way to the surface from depths greater than 100 yards, unless the thickness of the seam is considerable, or a thick bed of rock intervenes. A series of levels, extending over five years, were taken by the author with reference to two separate colliery royalties under which the coal was being worked at depths of 120 and 330 yards respectively. They proved, in the former case, that subsidence closely followed the extraction of the coal, and continued for 3½ years, amounting to 70 per cent. of the thickness excavated; while in the latter case, it followed somewhat later, continued for four years, and amounted to 64 per cent. of the thickness excavated. The strata in each case were fairly level, and of the average coal-measure character. If the site of works be over a fairly large area of goaf, even settlement may be expected; and when complete, the surface will be left nearly as before, though at a lower level. Works should be placed away from goaf edges, if possible. A period of two or three years at least, after the coal is extracted, should elapse before commencing works; and more, if practicable, in the case of deep mines. Water-works and reservoirs, where certain heights above sea-level are to be maintained, should not be constructed in mining districts unless the suitability of the site outweighs the cost of protection.

State Examination of Water in America.—According to "Science," the State Legislature of Vermont has passed an Act providing for the equipment and maintenance of a State laboratory, which shall include in its work the chemical and bacteriological examination of water supplies. The sum of £1000 has been granted for its establishment, and £1600 per annum voted for current expenses.

TECHNICAL RECORD.

ACETYLENE.

By Vivian B. Lewes, F.I.C., F.C.S.,
Chief Superintending Gas Examiner to the Corporation of London,
Professor of Chemistry at the Royal Naval College, Greenwich.

[The Third of a Course of Cantor Lectures at the Society of Arts, delivered Dec. 5, 1898.]

Accustomed as I have been to chemical actions of all kinds, more especially in the development and use of gases, I shall never forget the impression made upon my mind when, in the autumn of 1894, I first generated acetylene by the action of water upon calcic carbide obtained from Mr. Willson in America. There was something almost "uncanny" in the devolpment of this wonderful gas from the simple contact of the carbide with water; and I was the more impressed by it as I had spent several years in researches necessitating the making of considerable volumes of acetylene, and realized to the full the laborious and unsatisfactory nature of all the earlier methods for its production. It was with this carbide that I then made the experiments detailed by me in this room in January, 1895, when I showed you for the first time in this country the reactions which had caused me such keen delight, and also showed for the first time in any country how the gas could be consumed so as to develop to the full its marvellous illuminating power.

In the generation of acetylene from calcic carbide and water, all that has to be done is to bring these two compounds into contact, when they mutually react upon each other with the formation of lime and acetylene; while if there be sufficient water present, the lime combines with it to form calcic hydrate thus—

I.

Water H_2O lime.

X

Calcic carbide CaC_2 Acetylene.

II.

Lime.		Water.		Calcic hydrate.
CaO	+	H_2O	=	$Ca(HO)_2$

The wonderful simplicity of the reaction is its great beauty; and one would imagine that but little scope was afforded to the mechanical ingenuity of inventors in devising methods by which the necessary contact between the interacting bodies should be brought about. But a glance through the patent literature of the last few years, shows that where there is a will there's a way; and many of the weird devices protected under the name of acetylene generators, would lead one to suppose that the formation of this beautiful illuminant was one of the most complex problems ever submitted to the ingenuity of man.

There are manifestly two ways in which the carbide and the water can be brought together, either by adding water to carbide or carbide to water; while a slight amount of novelty can be introduced by allowing the water to rise in contact with the carbide from below—*i.e.*, by adding the water to the bottom of the carbide instead of to the top. I showed these three methods of procedure when I first described acetylene, and at the time thought that the question of generators was practically done with. But within a few months the idea arose of making automatic generators, in which the space necessary for a small holder should be saved by making the apparatus only generate the gas as it was needed; and a multitude of devices for stopping the generation of the gas when the consumption ceased were designed and placed upon the market.

Unfortunately the designers of these machines, though gifted with much ingenuity and mechanical skill, had but little idea of the properties of the body with which they were dealing; and as a result many of the generators, if not actually dangerous, are so arranged as to produce the gas in anything but its purest form, while some give a far smaller yield of gas per unit weight of carbide decomposed than others constructed on more rational principles. The different forms of apparatus shown at the exhibition at the Imperial Institute, held during the past summer under the auspices of this Society, may be taken as representing the best types on the market; and when a few weeks hence the report of the Committee is published, much interesting matter will be found in it, as a uniform quality of carbide being used throughout the exhibition for over a month's continuous working, direct comparison between the performances of the various generators becomes possible.

In considering the various forms of apparatus, it will be well to divide them in the first place into two classes: (1) the automatic, in which the storage capacity for acetylene is less than the total volume of gas the charge of carbide is capable of generating, and which depend upon some special arrangement for stopping the action of water on the carbide when the consumption ceases; and (2) the non-automatic, with which there is a holder of sufficient size to contain the whole of the gas generated

from the charge of carbide which is used. Each of these classes may be subdivided under three heads—

A.—Those in which water is, by various devices, allowed to drip or flow in a thin stream on to a mass of carbide; the evolution of the gas being regulated by the stopping of the water feed.

B.—Those in which water in volume is allowed to rise in contact with the carbide; the evolution of the gas being regulated by the water being driven back from the carbide by the increase of pressure in the generating chamber, or (B^2) by the rising bell of the gasholder drawing the carbide up out of the water.

C.—Those in which the carbide is dropped or plunged into an excess of water.

The points to be attained in a good generator are—

1.—Low temperature of generation.
2.—Complete decomposition of the carbide.
3.—Maximum evolution of the gas.
4.—Low pressure in every part of the apparatus.
5.—Ease in charging and removal of residues.
6.—Removal of all air from the apparatus before generation of the gas.

When carbide is acted upon by water, considerable heat is evolved; and to determine what this amounted to, a good sample of commercial carbide, containing 92 per cent. true carbide, was experimented with as follows: A rough calorimeter was made by jacketing a beaker about 5 inches in diameter with cotton wool. This arrangement, though crude, answered its purpose well, as experiment showed that some hot water placed in it only lost 0·2° C. after standing for ten minutes in a room at 18·6° C.—a loss which could be neglected. One piece of carbide, the weight of which was known, was dropped into a litre (1000 grammes) of water at a known temperature in the beaker; and the moment that the evolution of gas ceased, the temperature of the water was taken. The results were as follows:—

Grammes of Calcic Carbide.	Rise in Temperature.	Corresponding Calories Liberated.	Calories Liberated per Gramme of Carbide.	Time of Reaction In Seconds.
42·7	17·4° C.	17,400	407	62
28·9	11·4	11,400	394	91
19·7	8·2	8,200	416	73

which give as an average 406 calories liberated for each gramme of carbide.

Broken-up carbide, the pieces of which weighed from 1 to 5 grammes, was thrown into a litre of water in the beaker, in quantities of 30, 40, and 50 grammes respectively—

Grammes of Calcic Carbide.	Rise in Temperature.	Corresponding Calories Liberated.	Calories Liberated per Gramme of Carbide.	Time of Reaction in Seconds.
50	17·6°C.	17,600	352	248
50	18·4	18,400	368	86
50	18·3	18,300	366	123
50	18·4	18,400	368	106
40	15·6	15,600	390	109
40	15·8	15,800	395	101
40	15·0	15,000	375	196
40	15·5	15,500	387	110
30	11·7	11,700	390	76
30	10·8	10,800	360	89
30	11·8	11,800	393	114
30	11·4	11,400	380	85

or 377 calories liberated for 1 gramme of carbide.

The last experiment was repeated with carbide still more finely divided; and the results gave 384 calories for each gramme of carbide.

From these figures, it will be seen that, contrary to expectation, the smaller the carbide the less was the yield of heat; but the reason for this can soon be made evident. More time is spent in weighing out the finer carbide than in taking the weight of one large piece; and the larger surface presented by the small pieces causes greater decomposition by the moisture in the air than with the single lump. Hence the carbide is of poorer quality; and, moreover, the rapid evolution of gas in the case of small carbide prevents the water abstracting all the heat from it. Taking this into consideration, the 406 calories will most nearly represent the heat evolved by the decomposition of 1 gramme of good commercial carbide; and this would be equivalent to 414·6 calories for pure carbide. With this figure as a basis, it is evident that the action develops about one-twentieth of the heat evolved by the combustion of carbon. But the intensity of the temperature developed is a function of the time needed to complete the action; the decomposition of the carbide by water is extremely rapid; and the degree of heat attained varies with every form of generator. So that while the water in one form may never reach the boiling-point, the carbide in another may become red hot, and give a temperature of over 800° C.

When water drips upon carbide, as in generators of subdivision A, the temperature rapidly rises until it reaches a maximum after about 18 to 25 minutes; the actual heat developed depending upon the rate of flow of the water and the way in which it is distributed over the mass. But it is quite possible with generators of this class to reach from 400° to 700° C.; and it is probable that in some parts of the mass the higher limit is nearly always attained—traces of tar being generally found in the residual lime—and in some cases it is in sufficient quantity to make the lime yellow and pasty, while vapours of benzene and other polymerization products freely pass off with the gas.

Leaving the question of the temperature developed in this class of generator, another important point is the length of time over which generation of gas continues after the addition of water to the carbide has ceased. Makers of automatic apparatus of this type seem to think that, in order to stop the evolution of acetylene, all they have to do is to cut off the water supply. This would act very well if the generation of gas really ceased then. But this is not the case, as gas continues to be evolved, although with increasing slowness, for a considerable period after the cutting-off of the water. The length of time over which this after-generation extends will, of course, to a certain extent depend upon the amount of water added, the amount of carbide undecomposed, and the temperature of the carbide at the time when the water supply is stopped; while the generation will itself depend upon—

(*a*) The dehydration of the calcic hydrate first formed.
(*b*) The decomposition of water condensed from the gas present as the temperature of the generator falls.

As we have before seen, the first result of the action of water upon the carbide is the formation of quicklime and the evolution of acetylene; while if sufficient water be present, the lime takes up another molecule of water to form calcic hydrate. This molecule of water, however, at temperatures of from 420° to 430° C., is driven off from the calcic hydrate; and the affinity of the carbide for any water present causes the reaction—

$$CaC_2 + Ca(HO)_2 = 2CaO + C_2H_2$$

A series of experiments was made by placing a known weight of carbide in a generating cylinder, running in a known volume and weight of water in a given time, and carefully measuring the volume of gas for the first ten minutes, and again when the action had practically ceased; and not more than 1 cubic foot of gas was evolved in ten minutes. The results so obtained show clearly that in any apparatus on this principle the cut-off should be so arranged that at least one-fourth of the total holder capacity is still available to store the slowly generated gas.

An important point was noticed in these experiments—viz., the large excess of water required to ensure complete decomposition of the carbide over and above the theoretical quantity—and the excess of water needed was largely dependent upon the form of generator employed. According to theory, 64 parts by weight of carbide require only 36 parts by weight of water to completely decompose them and convert the lime into calcic hydrate. This would mean that each pound of carbide needs a little under half a pint of water to complete the action; while in practice, owing to the evaporation due to the heat of the action, half the added water is driven off as steam with the acetylene, or left mechanically adhering to the lime. The smallest quantity likely to complete the action would be a pint to a pound of carbide; while in reality the only safe way is to add sufficient water to drown the residue. If this is not done, the lime forms so protective a coating to the carbide that small quantities often remain undecomposed; and if the residues are thrown into a drain or cesspool, the evolution of acetylene would give an explosive mixture which, on account of its low point of ignition, would be a serious danger.

The second subdivision of generators B, in which water rises to the carbide, is very popular; and over-heating can be avoided in them provided they are so arranged that the water is never driven back from the carbide, and if the charge of carbide used is not too great. Under these conditions, the slowly rising water is always in excess at the point where it decomposes the carbide, so that the evaporation, by rendering heat latent, keeps down the temperature; and though the steam so formed partly decomposes the carbide in the upper portion of the charge, the action is never sufficiently rapid to give any very great rise of temperature. In order to fulfil these conditions, it is necessary that there should be a holder of considerable capacity, and that the leading tube conducting the gas from the generator to the holder should be of sufficient diameter to freely conduct away the gas; the water being allowed at the same time to rise in the generator so slowly as to do away with any risk of over-generation. In the best generators of this class, these conditions are more or less approached; and it is unusual to find that the melting point of tin—228°C.—has been reached in the charge of carbide during decomposition.

Where appliances of this class are automatic, and have no rising holder to take the gas, it is found that they work satisfactorily when supplying the number of lights for which they were designed. But if they are overdriven, and the action becomes too violent, excessive heating takes place; while the turning off of the gas, and consequent driving back of the water from the carbide, also has a tendency to cause it. If, however, the water has risen sufficiently slowly, the carbide below the surface has been practically all decomposed, so that the heating only takes place over a limited zone.

The generators of sub-division B^2 are the worst offenders as regards excessive heating; the charge of carbide in some of them frequently becoming red hot, while the lime taken from them is highly coloured and often black from the formation of tar and carbon.

The moment acetylene is subjected to the action of high temperatures, changes of great complexity begin. These at first are purely synthetical. At temperatures which are comparatively

low, the acetylene gas begins to condense to benzene; as the temperature rises, the condensation of four molecules of acetylene yields styrolene; and a further increase in the temperature may cause the styrolene and benzene to interact, yielding anthracene and hydrogen. It is probably at this point that the brown tar vapours appear, while naphthalene also is formed. At this temperature, moreover, a fresh set of interactions starts. The nascent hydrogen combines with acetylene to form ethylene; and this body, under the action of heat, breaks down into methane and acetylene once more.

When the outer layer of carbide decomposes, the gas is evolved so rapidly that there is no time for the heat to act upon it. But as the decomposition spreads into the centre of the mass the acetylene generated has to pass through the external layers, which, as shown, may be at a temperature above the point of its decomposition; and it is under these conditions that a considerable volume of gas is lost, and the tar often found in the residue, or distilled into the generator and tubes, is formed.

In generators in which excessive heating takes place, the tar is likely to cause considerable trouble, as it is of a very viscous nature, and if it condenses in the delivery tubes causes the lime dust and carbon particles to collect and bring about stoppage. A still more important evil, however, is to be found in the alteration which takes place in the composition of the gas, and which reduces its illuminating value to a serious extent. Two samples of gas taken while the charge in one of these generators was over-heating, gave the following results on analysis:—

Acetylene	70·0	69·7
Saturated hydrocarbons	11·3	11·4
Hydrogen	18·7	18·9
	100·0	100·0

Such a mixture would only have about one-half the illuminating value of pure acetylene. The large amount of hydrogen present in these samples also shows that decomposition of some of the acetylene has taken place; and a considerable deposit of carbon is often found in the generator. At first sight, these results seem an absolute condemnation of the second subdivision of apparatus; and the rising bell which draws a mass of wet carbide above the surface of the water is bad from every point of view. But generators in which water rises from below, and so attacks the carbide, can be made safe if the arrangements are such that the water is never driven back from the carbide, and the bulk of carbide is sufficiently subdivided.

The generators of the third class are those in which carbide is allowed to fall into an excess of water; and these have many advantages. In such generators, as long as there is water present, it is impossible to get above a temperature of 100° C., unless lime sludge be allowed to collect at the bottom, when the carbide will get hot enough to sometimes melt zinc; while with a properly arranged tank the temperature never exceeds the air temperature by more than a few degrees. Under these conditions, the absence of polymerization, and the washing of the nascent and finely divided bubbles of gas by the lime water in the generator, yields acetylene of a degree of purity unapproached in any other form of apparatus. The one thing that has militated against this method is that it is not easy to design such a generator which shall be automatic; and as this seems to be the craze from which the generator makers are at present suffering, its advantages have been apparently overlooked by them, though fully recognized by all scientific men.

This form of generator, however, though exhibiting the great advantages enumerated above, has the drawback of being one of the least economical in the output of acetylene per pound of carbide used, as the gas, having to bubble through the water, is rapidly dissolved by it; while in an apparatus in which only the surface of the water touches the gas, the amount dissolved is comparatively small. The result of this is that with apparatus of this class, the generation rarely exceeds 4·2 cubic feet of acetylene per pound of carbide, instead of over 5 cubic feet.

As regards the complete decomposition of the carbide, it has been already pointed out that in generators of the first subdivision there may be a small quantity of the carbide left undecomposed if water enough to flood the residuum be not admitted; while in non-automatic generators of the second subdivision, this is practically impossible. In generators of the third subdivision, in which carbide drops into a large excess of water, it might be imagined that any carbide in the residue was an impossibility. But, in point of fact, this class is often the worst offender in that respect; as if the generation has been in action for some time, a thick sludge of lime collects at the bottom of the generator, into which the carbide sinks. A large lump of carbide will then often bake for itself so tough a layer of oil and lime that it resists the action of the water, and is found unacted upon when the generator is cleaned out; the usual explanation given by the generator maker being that it is crust present in the "bad carbide."

In a good generator, the maximum yield of gas should be evolved from the carbide. But a fact which the generator makers have entirely overlooked up to the present time is that if you take a number of different machines and supply them all with exactly similar carbide, no two will give the same yield of gas; the best generators giving volumes approximating to 5 cubic feet per pound of carbide, while the worst will give barely 4 cubic feet—a result as usual placed at the door of the carbide. The causes which tend to diminish the volume of acetylene given off are—

1.—Undue pressure in the generator.
2.—The acetylene after generation having to pass through a column of water.
3.—Undue heating, causing polymerization.

The first of these is very noticeable, and is due to the increased volume of gas dissolved by water under pressure; as though 10 volumes of water at ordinary atmospheric pressure only dissolve 11 volumes of acetylene, at 2 atmospheres pressure it dissolves double the quantity. When acetylene is generated at or above the surface of water, but little dissolves at once—the top layer of water rapidly becoming saturated; but when the gas has to bubble up through a mass of water, as in generators of the third class, a heavy loss from solution takes place. The last cause has already been discussed, and is not so noticeable in its result.

The pressure in all parts of a generator should be as nearly as can be equal, and as low as possible; and this is best obtained by working freely into a gasholder of sufficient size. The Home Office fixed 100 inches of water as the limit of pressure permissible in generators; but I think myself it was a mistake to allow more than 20 inches, and I should certainly not advise the use of a generator which gave more than that amount.

Every part of the generator should be easily accessible, and complicated taps and valves should be avoided; while ease of charging and clearing should be attended to—ample room being provided in the generator for the increase in bulk which takes place when carbide is converted into lime. One pound of pure calcic carbide yields 1·15 lbs. of slaked lime (1 kilo of carbide yields 1156 grammes of slaked lime); and the volume this will occupy depends entirely upon the way the water is brought in contact with it.

In an automatic generator of the first subdivision, where water drips slowly upon the carbide in sufficient quantity to decompose it, but not to flood it, the lime swells up and occupies from 2 to 2·5 times the bulk of the original carbide. When, however, the water flows in more rapidly, the impact of the water beats down the lime and the space occupied is not so large. In generators of the second type, in which water rises from below, the weight of the undecomposed carbide above it presses down the lime below, and keeps it in a compact mass occupying about one-half more space than the carbide from which it was formed. In designing a generator of the third subdivision, the tank containing the water into which the carbide falls should be provided with a false bottom, so as to leave at least 8 inches to 1 foot of water below the point at which the carbide is decomposed, for the lime sludge to settle in; and experiments were made to see the rate at which the settling of the excess of lime took place. In these experiments, known weights of calcic carbide were dropped into a beaker containing a litre of water; and the results obtained were as follows:—

I.

Calcic Carbide.	Volume of Lime Paste Deposited during 30 Mins.	90 Mins.	Volume of Lime Paste Deposited during 30 Mins. Calculated for 1 grm. CaC_2.	90 Mins.
Grms.	c.c.	c.c.		
50	480	360	9·6	7·2
50	470	340	9·4	6·8
50	440	350	8·8	7·0
50	470	370	9·4	7·4
40	430	330	10·7	8·0
40	420	320	10·5	8·0
40	400	310	10·2	7·7
40	410	320	10·5	8·0
30	340	240	11·0	8·0
30	320	220	10·3	7·3
30	330	240	11·0	8·0
30	330	240	11·0	8·0
		Mean	10·2	7·6

II.

50	450	340	9·0	6·8
50	440	330	8·8	6·6
50	450	330	9·0	6·6
50	440	320	8·8	6·2
40	390	310	9·7	7·7
40	410	310	10·0	7·7
40	390	300	9·7	7·5
40	390	300	9·7	7·5
30	310	210	10·3	7·0
30	300	240	10·0	8·0
30	240	230	9·6	7·6
30	300	220	10·0	7·3
		Mean	9·8	8·6

After 30 minutes, the volume of lime was 10 c.c. per gramme of carbide; after 90 minutes, it was 8·1 c.c. per gramme. So that approximately, after an hour's standing, each kilo of calcic carbide will give 10 litres of lime sludge, or 1 lb. of calcic carbide will yield 8 pints, which can be got rid of by a cock at the bottom of the apparatus. The rapidity with which settling takes place is, of course, slightly affected by the form of apparatus.

Another requisite of a good generator, overlooked up to the present time, is that there should be an arrangement by which the air present in the generator can be rinsed out with some of the acetylene already made in the holder, or by some inert gas like carbon dioxide. I think this is a most important precaution, as recent researches by Mr. H. Gerdes show that, instead of acetylene requiring to be diluted with about twelve times its

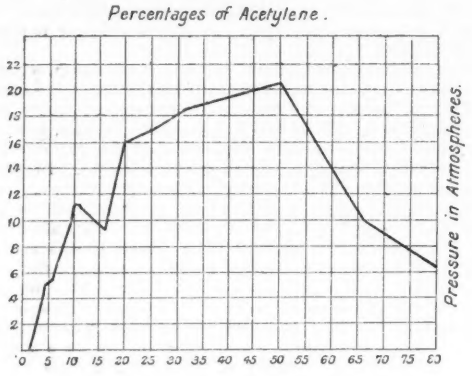
bulk of air in order to obtain the maximum pressure on explosion, mixtures of equal volumes of acetylene and air give the most powerful result. It must be remembered that the temperature at which acetylene decomposes into carbon and hydrogen with evolution of heat is 780° C.; but the temperature of ignition is 480° C., and in such a mixture the degree of heat needed to cause explosion will more nearly approach the latter than the former temperature. It is quite conceivable that in working on a big scale, the carbide might easily reach the necessary temperature, while such a mixture of acetylene and air still remained in contact with it. Indeed, I have come across several cases of explosion which could only be explained by this.

Working with 90 litres of the various mixtures in an explosion cylinder, and measuring the pressures by means of a manometer and indicator, the following results were obtained :—

Pressures Given by Exploding Mixtures of Acetylene and Air.

Percentage of Acetylene.	Atmospheres Pressure.	Percentage of Acetylene.	Atmospheres Pressure.
2·5	0·05	11·1	11·1
3·7	3·7	12·5	10·6
4·7	4·9	16·6	7·2
5·5	5·2	20·0	16·0
6·6	6·8	25·0	16·9
7·7	8·2	33·0	18·4
8·3	8·6	50·0	20·3
9·1	9·7	66·0	10·0
10·0	11·1	80·0	6·3

If these results be plotted out in a curve, it will be seen that there are two maxima of explosive force—



The first maximum of pressure occurs when completed combustion yields the greatest heat effect, and the acetylene is burnt to carbon dioxide and water vapour; and this mixture explodes with the greatest noise.

Mr. Gerdes explains the second maximum of pressure by the assumption that the carbon is gaseous at the moment of liberation; but I do no not think this theory is tenable. If a mixture of equal volumes of acetylene and air be ignited in an open cylinder 18 inches high, a lurid disc of flame runs down the cylinder, and a vast cloud of carbon is given off; but no sign of anything approaching explosion occurs. If, however, this be done in a closed vessel, the very slowness of the combustion brings about the explosion, as the combustion of the portion of the mixture first ignited creates a pressure under which the remainder detonates at the temperature of combustion, and gives the high pressure noticed in these experiments.

In experiments which I have made, I have found it extremely difficult to ignite such a mixture of air and acetylene in a tube by means of an electric spark; but if a flask be employed, so that a considerable volume of the mixture be present, the spark at once causes a violent explosion—the finely divided particles into which the glass is blown being an ample proof of the explosive force having been of an extremely sharp character. The fact that a mixture of one volume of air and one volume of acetylene burns extremely slowly in an open cylinder, and also the fact that it is difficult to ignite by a spark the mixture in small portions, is no argument against the explosibility of the mixture; as if you take a mixture of carbon disulphide and nitric oxide in a short cylinder, it burns with simply a bright flash of light which is noted for its richness in actinic rays, whereas if a very long narrow cylinder be employed it burns down to a certain point and then detonates, blowing the cylinder to pieces—such phenomena being entirely due to the increase in rapidity of combustion, which finally terminates in an explosion wave.

A good deal of the trouble arising in generators is due to the irregular development of the acetylene, which at first comes off with tremendous rapidity, and then, as the exterior carbide becomes coated with lime, gets slower and slower; while the after cracking off of this coating then gives irregular rushes of gas. Many attempts have been made to get over this trouble, perhaps the most successful being the decomposition of the carbide by means of a solution of sugar, which has the power of dissolving the lime as it is formed, and so gives a uniform and less rapid evolution of gas. But it, of course, increases the expense, and could only be available in the generators of table and bicycle lamps, where cost is a secondary consideration.

Alcohol also, mixed with the water, tends to regulate the generation. The effect of various oils in regulating the evolution of the gas has been tried with a certain amount of success, as if the carbide be coated with oil, it is protected from the action of water all the time the oil is clinging to the material. In one form of automatic generator, a layer of light oil is placed on the surface of the water. As the water rises past the carbide, the oil rises with it, and the action of the water on the carbide commences a few minutes after the water has come in contact with it and has had time to displace the oil; while on cutting off the gas the water is again driven down, and as the oil on its surface comes in contact with the partially decomposed carbide it is supposed to coat it and stop the after-generation. With very small generators, working well within their capacities, this may be successful; but with any large charge of carbide, the heat remaining in the lumps of solid material would probably be sufficient to distil out some of the light oil employed.

In concluding this part of the subject, I can only say I believe that, as time goes on, the tendency on the part of acetylene consumers will be to use the simplest form of generator available, with a holder proportionate to the needed consumption.

Abroad a good deal of work has been done on the purification of acetylene; and though this is desirable with the smallest installation, it becomes imperative when small towns or villages are to be supplied with acetylene instead of coal gas. As was pointed out in the last lecture, the purity of the acetylene gas primarily depends upon the purity of the carbide from which it is formed; and as long as it is commercially impossible to use absolutely pure calcic oxide and carbon, so long will there be always present in this material calcic phosphide, aluminium sulphide, and magnesium nitride, which on the decomposition of the mass by water will yield a gaseous and unwelcome addition to the acetylene of phosphuretted hydrogen, sulphuretted hydrogen, and ammonia.

Phosphuretted hydrogen, when it burns in the acetylene flame, gives rise to phosphorus pentoxide, which escapes into the atmosphere in the form of white fumes; and though the quantity is so minute that it is invisible as it leaves the acetylene flame, still, when mingled in quantity with the air of an ill-ventilated room, it is the primary cause of the production of a light haze, which ever since the introduction of acetylene for illuminating purposes has been recognized as a serious inconvenience in connection with it. The atmosphere of a warm room always contains large quantities of water vapour, derived both from the respiration of the occupants and from the products of the combustion of the illuminating flame; and under ordinary conditions this moisture remains suspended in the atmosphere in an invisible state. But as soon as traces of phosphorus pentoxide escape into it, this substance having a marvellous affinity for water, causes a condensation of a portion of the water vapour, and converts it into phosphoric acid; so that a very small trace of phosphuretted hydrogen in the gas itself gives rise to an amount of haze totally out of proportion to the actual phosphorus present. Where there is a considerable quantity of acetylene consumed, and no proper method of changing the air of the room, this haze will often be found; and it is undoubtedly injurious to health. I do not myself think that the whole of the onus of the haze can be laid at the door of the phosphuretted hydrogen in the acetylene; but it undoubtedly plays an important part in this action, upon which I am at present experimenting.

The sulphuretted hydrogen formed by the action of water on the aluminium sulphide in the gas is objectionable, not so much because it renders the smell of the acetylene offensive—a function which I look upon as a safeguard—but because in its combustion in the acetylene flame it forms sulphur dioxide, which, in ill-ventilated apartments, will absorb moisture and oxygen from the air, and will in this way become converted into minute traces of sulphuric acid which, concentrating themselves upon any cold surface in the room in the form of impalpable moisture, give rise to corrosion of metals and in time destruction of the binding of books, though the effect is but small upon such fabrics as have not the power of absorbing moisture or condensing it from the atmosphere. The chief objection to the third impurity present in the acetylene gas—ammonia—is that it leads to rapid action upon the brass gas-fittings, and is also an important factor in producing explosive compounds of acetylene with metals, though the experiments of Mr. Gerdes have shown that this is not a very real danger. It is quite clear, however, that acetylene, if it is to be used on a large scale as a domestic illuminant, must undergo such processes of purification as will render it harmless and innocuous to health and property. The sooner it is recognized as absolutely essential to purify acetylene before consuming it, the sooner will the gas acquire its deserved meed of popularity; while I shall be able to show next week that many other troubles will at the same time be overcome.

The only one of the impurities which offers any difficulty in removing is the phosphuretted hydrogen. There are three substances which can be relied on to remove this compound. The three methods are to pass the gas to be purified either through acid copper salts, through bleaching powder, or through chromic acid; and in experiments with these various bodies, it is found they are all effective in also ridding the acetylene of the ammonia and sulphuretted hydrogen, provided only that the surface area presented to the gas is sufficiently large.

The method of treating the gas with acid subsalts of copper has just been patented by Herr A. Frank, of Charlottenberg, the

celebrated gas engineer, who found that a concentrated solution of cuprous chloride in an acid is the most effective metallic solution to be employed; and this is absorbed by Kieselghur, and forms the purifying material. Where the production of acetylene is going on on a small scale, this method of purifying is undoubtedly the most convenient one, as the acid present absorbs the ammonia, and the copper salt converts the phosphuretted and sulphuretted hydrogen into phosphates and sulphides. The vessel, however, which contains this solution has to be of earthenware or porcelain, on account of the free acid present. The gas must be treated after purification, to remove traces of hydrochloric acid; and this is done with lime.

The second process is one patented by Dr. Ullmann, of Geneva, who utilizes chromic acid, which oxidizes the phosphuretted and sulphuretted hydrogen, and absorbs the ammonia; while the third process owes its inception to Lunge, who recommends the use of bleaching powder for the purification of acetylene. But Dr. Wolff has found that when this is used on a large scale there was a risk of the ammonia present in the acetylene forming traces of chloride of nitrogen in the purifying boxes; and as this is a liquid which detonates with considerable local force, it occasionally gives rise to explosions in the purifying apparatus. If, however, the gas be first passed through a scrubber so as to wash out the ammonia, this danger is got rid of; and Dr. Wolff employs purifiers in which the gas is washed with water containing calcic chloride, and is then passed through bleaching powder solution or other oxidizing material.

The form of apparatus employed in the generation of acetylene has a remarkable influence upon the proportion of sulphuretted hydrogen and ammonia present in the gas, though it affects but little the quantity of phosphuretted hydrogen. A long series of experiments which I have made shows that when the acetylene is generated in machines of the third subdivision, the ammonia is entirely eliminated; while the passage through the lime water reduces the amount of sulphuretted hydrogen present to a mere trace (which may be neglected) but has little or no effect upon the phosphuretted hydrogen.

Analyses given by Dr. Wolff of acetylene generated from American, German, and Swiss carbide as at present made, give the following results:—

	American.	German.	Swiss.
Phosphuretted hydrogen	0·05	0·03	0·03
Sulphuretted hydrogen	0·08	0·07	0·10
Ammonia	0·08	0·07	0·11
Hydrogen	0·09	0·07	0·16
Nitrogen	0·42	0·20	0·34
Oxygen	0·87	0·55	0 63
Acetylene	98·41	99·01	98·63
	100·00	100·00	100·00

While analyses which I have lately made from the ordinary commercial English carbide, and from the pure carbide made in France in the Herolt furnace by the tapping process, are as follows:—

	English.	French.
Phosphuretted hydrogen	0·138	0·045
Sulphuretted hydrogen	0·064	0·048

On taking a sample of English carbide, and decomposing it by the dripping process, there is found 0·138 per cent. of phosphuretted hydrogen and 0·064 per cent. of sulphuretted hydrogen; while if this carbide is allowed to fall into water, the acetylene so generated contains 0·126 per cent. of phosphuretted hydrogen, and the sulphuretted hydrogen is practically eliminated. When the carbide is dropped into a solution of sugar, the same result is obtained, and no traces of sulphuretted hydrogen can be detected in the gas so generated.

AMERICAN GASLIGHT ASSOCIATION.

The Twenty-Sixth Annual Meeting at Niagara Falls, N.Y.

(*Concluded from p.* 1295.)

A paper entitled "Notes on Mains and Mainlaying," was read by Mr. Walton Forstall, of Philadelphia. The exigencies of modern street traffic, the use of larger service pipes, and the decreased cost of iron, combined to render heavy sections of cast-iron pipe the cheaper in the end. The smallest size service he laid was 1¼ inch, and the largest 4 inch; all above this size being treated as mains. Where practicable, the hole for the service was always full sized; a split sleeve or a tee-piece being used on small mains. But if this could not be done, a 3-inch main was not tapped for a connection larger than ¾ inch; and a 4-inch main, for more than 1 inch. Special arrangements were made with a view of reducing the number of sizes of tees, sleeves, &c., that had to be kept in stock, and also in providing for possible future enlargements. In connecting up mains, saddle-pieces, sleeves, or tees were used, according to the size of the branch as compared with that of the stem. Small mainlaying work could be done by the works staff; but large jobs necessitated the services of contractors, either for the excavating only or for the whole job. When the contractor was called in, there should be a clear understanding as to the extent of his responsibilities. The new work should be carefully and systematically tested for soundness by applying air pressure up to 2 lbs. per square inch, and going over each joint with soapy water; and in contract work the company should provide an adequate number of inspectors. The contractor's sole idea was profit; and he was apt to neglect the comfort or convenience of the public, and thus land the company in popular disrepute. The specification should be so drawn as to enable the company to exercise control in this matter; and the author added, as an appendix to his paper, a set of specifications as used for about 80 miles of pipe let by contract. These provided the usual powers of control on the part of the gas company's engineer, and also enabled him to call for the removal of any employee who might, in his opinion, be incompetent, negligent, or otherwise conducting himself in a manner prejudicial to the interests of the company. All materials delivered to the contractor were accepted by him as sound; and if subsequently found to be cracked or defective, they had to be replaced at his expense. The location and levels of the trench were to be fixed by test-holes, carried sufficiently in advance of the work to avoid delay. All spoil was to be so placed as to cause the least possible inconvenience to traffic; and bridges over the trench were to be provided where necessary. The mains were to be laid on undisturbed earth at a clear depth of 3 feet below the surface; and where the trench was cut in solid rock, they were to be blocked up 4 inches clear from the bottom of the excavation—the 3 feet depth being observed as before. The contractor was to afford every facility for testing the work under not less than 2 lbs. per square inch pressure to the satisfaction of the engineer; and the depth of lead in joints, and all other details, were fully set forth. Payment was to be made every fortnight to the extent of 90 per cent.; the balance being retained for twelve months as a security for the contractor preserving the trenches in proper repair for that period. For several reasons, however, the author preferred that the work of mainlaying should be carried on by the permanent staff of the company, under the direct control of the engineer. But in this case it was necessary to keep a close oversight of costs, as foremen accustomed to small jobs were apt to be satisfied with a great deal less than an attainable day's work; and it was necessary to make them understand that their value to the company depended upon the cost per foot-run of main laid. Specials should be fitted with all socket-ends, as spigot-pieces were always accumulating; and for reducing, a bushing, consisting of a socket cast eccentrically inside a plug in such a manner as to preserve the level, was recommended. It was preferable that the socket should be actually inside, and not an outside attachment to the end of the plug. For obtaining a record of already existing mains, there was nothing like the service cards and street information cards; but with new work it was possible, by having a series of section maps on a large scale, each numbered and located on a key map, to preserve a record of the position of every joint. Sketches showing levels and other details could also be taken; and in one case these were all executed on tracing cloth, from which prints were taken for daily use—the originals being safely stored in fire-proof quarters. The author described a method by which he had been able to connect up a 24-inch pipe to a plug on a 36-inch pipe, without interfering with the supply of gas in the latter. The outline of the 24-inch hole was drilled out in the plug with small holes, as close together as was safe. There were also two segmental lines dividing the disc into three equal parts. A chain being firmly secured to each of the three portions, a 24-inch flange-piece, valve, and short socket-piece were fixed in place; the valve being open, and the chain threaded through. A disc was then secured to the open end, having a hole in the centre, through which the chain was threaded, and three other small holes, through which bars long enough to reach the drilled segments were passed. By means of a sledge hammer, the 24-inch disc could be knocked in one segment at a time, the bars withdrawn, and the segments pulled through the valve by the chain, leaving all clear. The valve could then be closed.

The President having invited discussion, Mr. Shattuck agreed with the new heavy sections proposed, so far as small sizes of main were concerned; but for sizes over 24 inches, he thought the Society of Gas Lighting standard was ample. He objected to the use of split sleeves, service sleeves, and saddle-pieces, on the ground that they were quite as much trouble to fix as an ordinary branch-piece, and not so simple or effective. He described a new form of mainlaying derrick, by means of which one man could raise or lower a 24-inch pipe. Mr. Littlehales thought the difficulty of making absolutely tight joints was not generally realized. The fire-test was worthless for locating leakages, and soapsuds not infallible. Trouble was caused by a desire for too quick, or too cheap, work. He inquired the smallest leakage per mile of main, and said the quantity stated as a percentage of the total gas sold was utterly misleading. One omission in the specification quoted was no mention of removal of ashes, or substitution of soil for ashes where met with. Ashes were very destructive; pipes laid in them were speedily pitted. He exhibited a model of a home-made pedometer, comprising a bicycle wheel and an old discarded meter-index. Mr. Jenkins objected to wrought-iron service-pipes of more than 3 inches diameter. He thought the opening in the main should always be as large as the service-pipe; and the question of attention to the convenience of the public was a very important point. Mr. A. S. Miller criticized some of the author's conclusions; and he especially objected to tying the

contractor down too tightly. This individual naturally expected to make a profit; and his side of the argument should receive consideration. Mr. J. J. Humphreys, junr., believed in the soap-bubble test for joints, and the hammer test for soundness of castings.

Mr. Walton Forstall, in replying, said it was understood that good work should not be sacrificed for the sake of speed, and ashes were not mentioned in the specification because they did not exist in the districts concerned. As to leakage, he was satisfied with anything under 100,000 cubic feet per mile of main per annum.

Mr. H. L. Rice, of Norfolk (Va.), contributed the results of some tests on a gas-engine used for driving the fan for the air-blast of a water-gas plant. He had a No. 6 Sturtevant blower, which could be operated either by a Sturtevant upright steam-engine or by a 25-horse power Westinghouse gas-engine. The steam-engine was rated at 15-horse power; and the gas-engine had its speed reduced from the normal rate of 350 to 275 revolutions per minute, so as to make it about 16-horse power. Steam was also required for the blast, in addition to that used for the steam-engine; and the method of working was to carefully weigh the boiler fuel when the steam-engine was in use, and again when the gas-engine was running. The average of several tests showed that the cost per 1000 cubic feet made was about 0·75d. in the first case and 0·63d. in the second. The gas-engine saved 0·12d. in cost of fuel, and used 15 cubic feet of gas to do so. Therefore 1000 cubic feet of gas was only equivalent to about 8d. in value of the fuel, which consisted of half screenings and half coke or coal. In a working day of 10½ hours, he made 48 runs and blows, yielding 168,000 cubic feet of gas. During this time, the gas-engine used 2400 cubic feet of gas, and was blowing for one-third and running idle for two-thirds. It consumed 340 cubic feet per hour when at work, and 170 cubic feet when idle; and the consumption could not be reduced below this figure. Nearly one-half of the gas was therefore consumed in keeping the engine running idle, which was a great disadvantage to the gas-engine, as the steam consumption could be cut much lower during the runs.

Mr. A. E. Forstall, of Montclair (N.J.), read a paper entitled "Can We Make All Our Business Pay?" He said that at first little attention was paid to reducing the cost of manufacture or developing business; but the need for economizing at the works, so as to deliver gas into the holder at the lowest possible cost, soon became apparent. It was only lately, however, that the need for attention and systematic working in the sales department had been recognized. There were many points in connection with the selling of gas that would repay careful attention. All lines of business were not actually profitable; and some might be conducted at a loss. If such was the case, the question was how to convert the losing lines into profitable ones. He supported this argument by summarizing a contribution to the "JOURNAL OF GAS LIGHTING" by Mr. Norton H. Humphrys, entitled "Both Sides of the Ledger," and went on to say that the key to the solution of the problem was furnished by a paper read before the Association in 1891 by Mr. Walton Clark, entitled "Meter-Rents: A Question of Equity and Policy." Mr. Walton Clark advocated a fixed charge per consumer, sufficient not only to cover the maintenance of the meter, but also that of the service, the cost of establishment, rental-clerks, collectors, &c., as it was more equitable to make these expenses a charge per consumer than a charge per 1000 cubic feet of gas sold. Every gas company had a number of small and irregular consumers on their books, who were really served at a loss. Electric light companies had met the difficulty by a system of minimum charges; and gas companies should follow a similar plan. Applying these arguments to his own undertaking, he found that a fair fixed charge per meter per annum would be: 3-light, 9s. 4d.; 5-light, 10s. 6d.; 10-light, 12s. 1d.; 20-light, 13s. 9d.; 30-light, 15s. 10d.; 45-light, 21s. 3d.; and 60-light, 25s. 10d. This would enable him, while retaining the present rates of profit, to sell gas at 6d. per 1000 cubic feet. The effect of applying such a system would be that consumers of less than a certain quantity of gas per annum would pay more; while the others would pay less. The increased charge to very small users would be so great that they might prefer to close their accounts; but this would not be a matter for regret, seeing that they were a source of loss. About 63 per cent. of his consumers would find their charges increased; but with nearly half, the addition would be trifling. The effect of the increase might be also minimized by introducing the system concurrently with an all-round reduction in price. One difficulty would be that in some cases the increased cost to the small consumer might exceed the limits fixed by law. It might be argued that the gas company had no right to charge for what was not used; but if electric light companies had the power to make a minimum charge of 4s. per month, he thought the sauce for the electric goose was also applicable to the gas gander. His proposition was not perfect, as it did not recognize the difference between day and night consumption, or summer and winter business; but he presented it as an advance, on the lines of equity and policy, upon the plan of a fixed charge per 1000 cubic feet.

Some other subjects were then discussed, and attention was next directed to the Question-box. The first item was the suggestion that 3-light meters should be provided with the same size union as 5-light ones. The idea was generally approved, though it was pointed out that considerable expense would be involved in regard to replacing the large number of 3-light meters at present employed. Mr. Harbison thought this object could be met by discontinuing the use of the 3-light size; and this brought several members to their feet, to speak in favour of the 3-light meter. Attention was next directed to the best method of separating oil vapours from water gas without the use of water, and to the effect of treatment with water on the candle power. Mr. A. S. Miller had tried a scrubber packed with slats 1 inch square and a similar distance apart; but this was only partly successful. He next tried the Pelouze-Audouin condenser, as well as some special designs of scrubbers; but without success. He then found out that the vapour was completely removed by passing the gas through a pipe packed with shavings; and he had just ordered six scrubbers, each 10 feet diameter and 24 feet high, to be packed with shavings. In his experience, the loss of illuminating value by the scrubbing process was about 2 per cent. If a purifier-box was packed with shavings in the same way as with oxide, the tar would soon get through; but if the layers were so boarded over as to cause the current of gas to travel horizontally through a considerable thickness of shavings, the result would be a success. The shavings would pass 35,000 to 40,000 cubic feet of gas per bushel before requiring renewal. Mr. Egner had used with success a layer of shavings at the bottom of each purifier. Mr. Knapp gave details of the manner in which he had employed shavings packed in scrubbers, and said the effect on the illuminating value of the gas was *nil*. Some trouble was caused by back-pressure at times; and this was remedied by turning on a jet of steam. He had also removed oil vapour by means of a centrifugal fan, and believed that it would be possible to make an apparatus on this principle that would not only take out all the tar, but also act as an exhauster.

After dealing with some more questions, the meeting closed with the usual votes of thanks.

THE ESTIMATION OF HYDROGEN, MARSH GAS, AND NITROGEN IN MIXTURES OF GASES.

A Fractional Combustion Method.

Herr E. Jäger, Chemist to the Municipal Gas-Works at Charlottenburg, has described in a recent number of the "Journal für Gasbeleuchtung," a new method for the volumetric analysis of the residual gases which remain when the other constituents of illuminating gas have been absorbed in the ordinary course of a gas analysis by the customary absorbents. Instead of adding air or oxygen to the residual gases and exploding the mixture, Herr Jäger proposes to use a method of fractional combustion, which is described in the following abstract translation of his paper in our German contemporary.

The methods hitherto generally adopted in technical gas analysis for the volumetric determination of the hydrogen, marsh gas, and nitrogen are based almost without exception on the principle of adding to the gas under examination an excess of air, with or without an addition of detonating gas, and, after combustion, observing the contraction, and the amounts of carbonic acid and of residual nitrogen. From the results of these observations, the proportions of hydrogen, marsh gas, and nitrogen in the gas are calculated. But a large amount of air, and a comparatively small amount of gas, have to be used in this method of determination; and unless the gas is confined over mercury, and readings of the barometer and thermometer are made with great precision, considerable errors are liable to be introduced, and the results, especially so far as the nitrogen is concerned, are often quite unreliable. In order to work with a greater amount of gas, and thereby facilitate its measurement with precision, and permit the use of water as the confining liquid, the author has endeavoured to use copper oxide as a means of supplying oxygen for the combustion. Fresenius and Stöckmann had previously employed cupric oxide for the estimation of hydrogen and marsh gas. They led several litres of the gaseous mixture over red-hot cupric oxide, and calculated the amounts of hydrogen and marsh gas from the weights of the products obtained. The use of cupric oxide gives a means of burning the gas without mixing air with it; and therefore the whole bulk of the gaseous residue which remains after the usual absorbents have been applied to illuminating gas can be used for the estimation, instead of merely a fractional part of it, as in the ordinary methods of analysis.

Cupric oxide, especially when it is in powder, is reduced by hydrogen at temperatures considerably below incandescence. But marsh gas is not consumed so readily as hydrogen; and advantage is taken of this fact. Trials showed that when a mixture of hydrogen, marsh gas, and nitrogen was passed slowly to and fro over cupric oxide heated to 250° C. (482° Fahr.) two or three times, the whole of the hydrogen was burnt; while the marsh gas—and, of course, the nitrogen—remained unaffected. The contraction produced by this treatment will give directly the amount of hydrogen burnt. If the cupric oxide is then heated to incandescence, and the remaining mixture of marsh gas and nitrogen is passed over it, the marsh gas is burnt; and on passing the gas into a Hempel pipette charged with solution of caustic potash, the observed contraction due to the absorption

of the carbonic acid produced by the combustion, will be equal to the volume of marsh gas in the mixture. The volume of residual gas will be that of the nitrogen in the mixture.

The necessary apparatus for the determination is shown in the annexed figure. H (fig. 1) is a Bunte burette, which by an alteration in the three-way cock, the nature of which is quite clear from the illustration, is adapted for coupling up with a Hempel gas-pipette. It is connected with the combustion tube *r*. This tube is shown, one-third its natural size, in fig. 2. The end r_1, which is connected with the burette, terminates in a capillary; but the other end, r_2, is sufficiently wide internally to admit of the introduction of the powdered cupric oxide. A granule of cupric oxide is first introduced, in order to prevent the asbestos fibre which follows blocking the capillary. About 3 grammes of powdered cupric oxide are then added, and fill the tube to within a short distance of r_2, which is plugged with

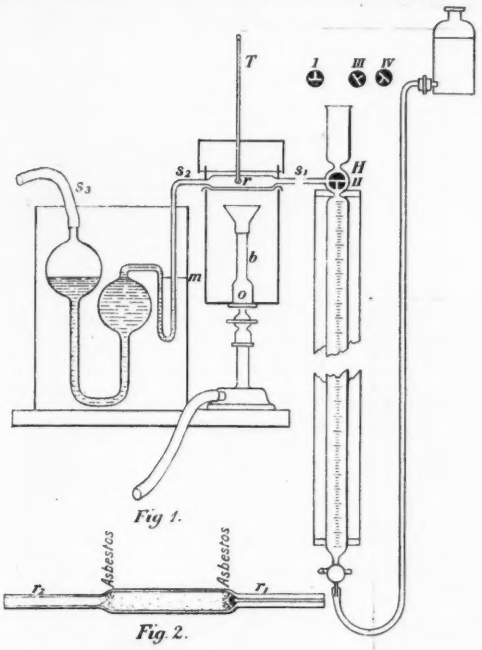


Fig 1.

Fig. 2.

asbestos fibre. The filling of the tube can be performed in about 2 minutes; and after a combustion has been made, the oxide can be emptied into a crucible, gently ignited while it is stirred, and returned to the tube for further use, when thus re-oxidized. The re-oxidation can in this way be performed more rapidly than in the tube itself. The combustion-tube is placed in a small oven, made of iron-plate, which is supported by the burner *b*. Through the top of the oven, a mercury thermometer, graduated up to 360° C. (680° Fahr.), is inserted, so that the bulb is near the combustion-pipe.

The solution of caustic potash rises in the capillary of the Hempel's pipette to the height *m*; and while the three-way cock is in position I, atmospheric pressure prevails in the combustion-tube. Joints made at s_1, and s_2, by means of flexible tubing, are rendered completely gas-tight by being bound with copper wire. To test the soundness of the joints, the cock is turned to the position III; and the operator blows vigorously through the flexible tube attached at s_3, and closes that tube by compression between the fingers, so that there is a pressure within the apparatus. He should be unable to raise the seal more than a few centimetres above *m*, and the level should remain unchanged until he removes the pressure, whereupon the seal should return to its original position. When the apparatus has thus been proved to be sound, the three-way cock is turned to the position IV; and the burner is lighted and the tube raised to a temperature of 250° C. (482° Fahr.). The cock is thereupon turned to the position II, and the gas is passed through the cupric oxide, at the rate of about 100 c.c. in 8 minutes. If, as is usually the case, no difference is observed between the volumes of the gas after the second and third passage through the oxide, the combustion of the hydrogen may be considered finished. After the gas has cooled, the contraction which has taken place is observed. The contraction needs correcting, because, firstly, the reduced copper occupies less space than the cupric oxide, and, secondly, the oxygen in the air present in the tube and the capillaries takes part in the combustion, and disappears. The first of these reductions of the volume is very trifling, and in ordinary cases may be ignored. Thus, supposing 100 c.c. of marsh gas were burnt, 1·43 grammes of cupric oxide, occupying a volume of 0·24 c.c., would be reduced to 1·14 grammes of copper occupying a volume of 0·13 c.c. The diminution of volume would therefore be 0·24−0·13=0·11 c.c. In most cases, however, mixtures of marsh gas and hydrogen in which the latter preponderated would be under examination; and hydrogen reduces only about a third the amount of cupric oxide which is reduced by the same volume of marsh gas. The diminution of volume in such cases falls to a few hundredths of a cubic centimetre, and is thus negligible.

The second of the reductions of volume mentioned is of greater importance. For practical purposes, a simple combustion made with each apparatus will give once and for all the necessary correction. Thus, in one experiment, the combustion tube and the connecting capillaries were filled with air, and 95·0 c.c. of pure hydrogen and 5·1 c.c. of nitrogen were enclosed in the burette. The contraction on combustion amounted to 95·8 c.c., showing that it was 0·8 c.c. greater than the quantity of hydrogen present. This difference must consequently be the amount of oxygen which was present and entered into combustion. In another experiment, the combustion-tube and the capillaries were filled with nitrogen, and 95·6 c.c. of pure hydrogen and 4·0 c.c. of nitrogen were enclosed in the burette. The contraction in this case was 95·6 c.c., or precisely the volume of the hydrogen present. Another experiment shows the manner in which the correction can be most easily ascertained. In the burette were enclosed 94·4 c.c. of pure hydrogen and 5·3 c.c. of air; and the contraction, after combustion, was 96·2 c.c., of which 94·4 c.c. was due to the hydrogen, and 1·06 c.c. to the oxygen of the air enclosed in the burette. The balance—0·74 c.c.—is the correction; and this agrees closely with that found in the first experiment.

That it is only the hydrogen which is attacked when a mixture of hydrogen and marsh gas is passed over cupric oxide heated to 250° C., is shown by the following results of a trial: There were measured into the burette 37·15 c.c. of pure hydrogen and 55·75 c.c. of almost pure marsh gas. The mixture was passed four times through the cupric oxide in the tube heated to 250° C. The time occupied in each passage through the oxide was some 8 minutes. The total contraction after each passage was: (1) 35·40, (2) 37·70, (3) 37·90, (4) 37·95. The necessary correction was 0·80 c.c.; and, therefore, the volume of hydrogen found was 37·95 − 0·80 = 37·15 c.c.

The combustion-tube was then heated to bright redness, and the passage of the gas through it continued until no further contraction was observed. The volume of methane found was 54·35 c.c.; and a residue of nitrogen, amounting to 1·40 c.c., was shown to be present. This experiment proves that only the hydrogen is consumed at 250° C., and that the two gases may be thus burnt quantitatively in succession.

The burette used should, if possible, be graduated throughout its length in 0·1 c.c. divisions. In analyses of illuminating gas, the whole of the residue which remains after the absorption of carbonic acid, hydrocarbons, oxygen, and carbonic oxide is treated by this method. When small quantities of hydrogen and marsh gas in generator gases are determined by this method, it is advisable that the cupric oxide used should contain some reduced copper; otherwise the oxygen in the air in the tube may be more than is sufficient to burn the small quantities of hydrogen and marsh gas. If, however, some reduced copper is present, the ordinary correction for the contained air may be applied quite correctly in the usual manner. If the gas under examination contains a large proportion of nitrogen, it is especially necessary that the gas should be passed very slowly through the combustion-tube. This caution applies more particularly to the combustion of the methane.

The method may be very readily applied to the simple determination of the nitrogen in coal gas or water gas. This determination is often of great value in the practical working of plant. Into the burette 100 c.c. of the gas are taken; and the combustion-tube is straightway heated to a red heat, and the gas is passed through it. The whole of the gas is thus burnt; and carbonic acid originally present in it, as well as that formed by the combustion, is absorbed by the solution of potash. Finally, nitrogen only will remain, and, after cooling, the volume of the residue is observed. If this volume is found to be, say, 0·6 c.c., then the correction 0·8 c.c. is added to it; and the percentage of nitrogen in the gas is thus found to be equal to 1·4.

The method of estimation described in this paper appears from the examples quoted to give very satisfactory results; and as it can be easily carried out, it seems to be well worthy of commendation.

Detection of Poisoning by Acetylene Gas.—According to an abstract in the "Journal of the Society of Chemical Industry" of a communication by Signor Vitali to the "Boll. Chim. Farm.," in all cases of acetylene poisoning, the acetylene should be sought for in the blood and the lungs. It both cases it may be isolated by reason of its great solubility in acetone. The lungs are cautiously evacuated, and the gases passed through acetone. In the solution, the acetylene may be detected by ammoniacal silver nitrate, ammoniacal copper solution, &c. The blood is agitated with acetone and the mixture heated, when the acetylene passes over with the acetone vapour, and may be detected in the distillate. If the blood is no longer fresh, carbonates and sulphuretted hydrogen are precipitated by iron sulphate, so that they may not interfere with the reactions. As acetylene is contaminated with phosphorus and sulphur compounds, these also occur in the acetone solution, and may, after oxidation with chlorine water, be detected without difficulty as phosphoric and sulphuric acids.

CLAY'S NEW ANTI-VIBRATORY GAS-FITTINGS.

Numerous appliances have been introduced to neutralize the effect of shock or vibration on the mantles of incandescent gas-burners; and a simple, but very effective, anti-vibrating fitting, designed by Mr. W. R. Clay (of Messrs. Clay and Walmsley), of Bolton, has been already noticed in the "JOURNAL." Recently, reference was made to further improvements which Mr. Clay was introducing in these fittings; and we now give illustrations, with descriptive particulars, of his latest inventions in this direction.

Mr. Clay's first invention, it may be briefly stated, consisted practically in forming a thin metal tube, conveying gas to the burner, into a resilient coiled spring, which, under conditions which would have proved destructive to an incandescent burner fixed in the ordinary way, effectually prevented it from any appreciable shock. This anti-vibratory fitting enabled the incandescent gas-light to be used under circumstances in which previously its adoption had been abandoned, owing to the frequent destruction of the mantles; but its extreme sensitiveness to the least vibratory wave was found, under certain conditions, to be rather a defect, as, owing to the lightness of the incandescent burner, and the consequent lack of inertia, the result was that when once the fitting was agitated, the state of motion was kept up for a considerable time. Mr. Clay has now overcome this disadvantage by an arrangement for supplying the necessary amount of inertia which the burner lacked, and has applied a method of ballasting the fitting by attaching a heavy body to the base of the burner, as shown in fig. 1. In this way, jerky movements have been rendered impossible; and it has proved a very successful modification in bringing the coiled pipe anti-vibrator more nearly to perfection.

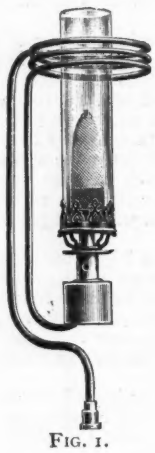


FIG. 1.

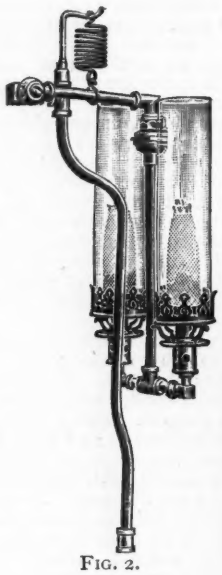


FIG. 2.

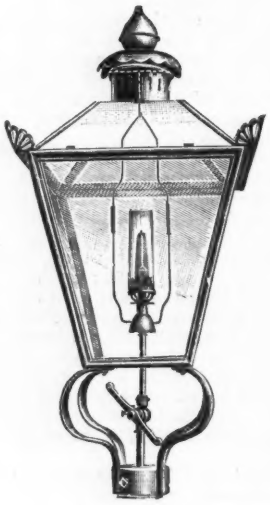


FIG. 3.

FIG. 4.

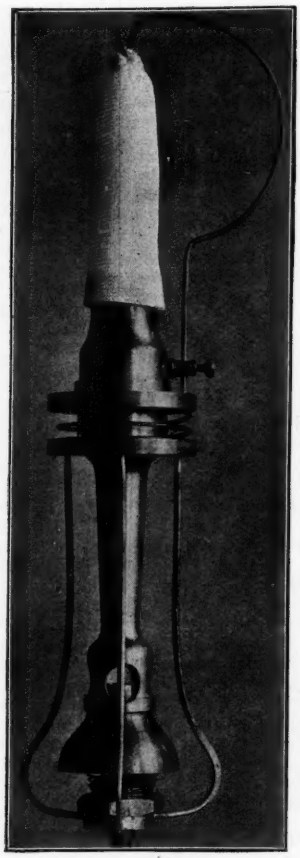


FIG. 5.

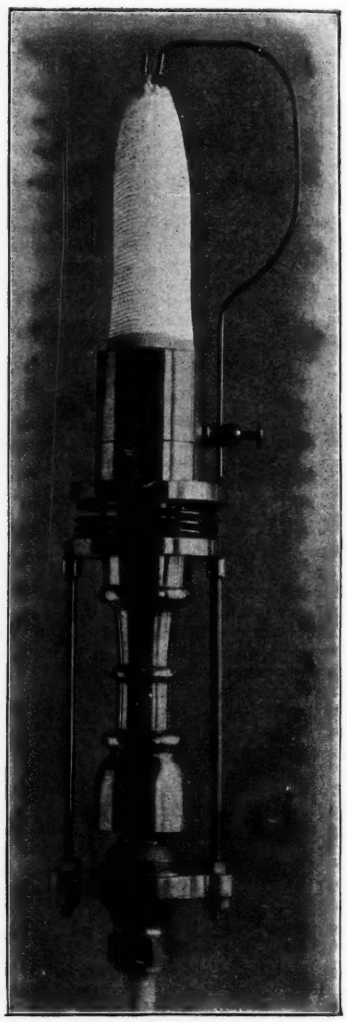


FIG. 6.

Mr. Clay, however, has not been content with this improvement on his first invention, but has branched out into quite new lines, in introducing further developments for the protection, in a variety of ways, of mantles from destructive shock; and we give several illustrations of his new arrangements. Fig. 2 shows a cantilever anti-vibrator in a form applied to a couple of incandescent lights; but made in a number of designs for different requirements; and the illustration furnishes a sufficiently clear indication of its construction to dispense with further explanation. The most important, however, and the latest, of Mr. Clay's inventions is what he has termed his new patent "Floating Bunsen" anti-vibrator, in which no pipe of any kind need be used—that is to say, as part of the apparatus. One form in which a simple arrangement of this appliance may be used is that of a street-lamp, shown in fig. 3, for the purpose of suspending thereon one of the ordinary "C" burners, though any other kind of incandescent gas-burner can be similarly treated. This form of anti-vibrator consists simply of a wire frame, at the bottom of which is attached a cone; the frame being also provided with sensitive springs to give the resilient effect. In order to adapt this anti-vibrator to an incandescent burner, the nipple of the burner is screwed on to the existing gas-pipe in the lantern, while the bunsen from which it is taken is screwed on to the cone. If, however, there should be any objection to this method of suspension, the burner may be supported in the manner shown in fig. 4, where the bunsen tube is fitted with springs upon which rests a heavy body carrying the gallery portion of the burner. A further design is shown in fig. 5, whereby a high-power burner of the Denayrouze type may be rendered shock-proof when supported. Mr. Clay has also designed a high-power burner (fig. 6) in which the bunsen is absolutely disconnected from the gas-supply pipe; and he is arranging cluster burners in which one bunsen tube and mixing chamber will supply from three to almost any number of mantles; but for cases where it is desired to have only a few incandescent, a floating bunsen cluster burner is being devised, whereby this

may be easily accomplished. In every instance, bye-passing of the gas is readily provided for.

Mr. Clay claims for his inventions that they are absolutely fireproof; dispensing altogether with the rubber attachment in some fittings of this class which is so much condemned by fire insurance companies; while their lasting properties are assured, not only by their simplicity of construction, but by the fact that they are made from a special mixture of copper which is claimed to be practically unperishable.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

A Special and a General Meeting of this Association was held last Saturday, at the Westminster Palace Hotel—the PRESIDENT (Mr. W. Matthews, M.Inst.C.E., of Southampton) in the chair. There was an excellent attendance.

SUBSEQUENT COUNCILS AND TERM OF OFFICE.

The Special Meeting was held to consider a proposal to substitute a new rule for Nos. 30 and 31. It was adopted, but will not come into operation until after the next annual meeting. The new rule provides that the Council shall consist of the President, Past-Presidents, two Vice-Presidents, Honorary Secretary and Treasurer, and ten ordinary members. Excepting the Past-Presidents, all will go out of office each year at the annual general meeting, but will be eligible for re-election. Voting-papers are to be sent to each member fourteen days before the winter general meeting; and nominations for vacant offices are to be sent to the Secretary thirty-one days before that meeting. Two Scrutineers are to be appointed at the meeting to examine and report upon the voting-lists; and the result of the voting is to be declared by the Chairman. Every Past-President at the expiration of five years from the termination of his Presidency is to go out of office, but will be eligible for re-election to the Council in the ordinary way.

CONFIRMATION OF MINUTES.

At the Ordinary Meeting, the business was commenced by the SECRETARY (Mr. W. H. Brothers) reading the minutes of the annual meeting held at Southampton in May last; and they were confirmed.

ADDITIONS TO THE ROLL.

The Scrutineers (Messrs. C. Sainty and T. L. Hughes) reported that their examination of the balloting lists for new members and associates showed that the following had been unanimously elected:—

Members.—Mr. J. R. Downes, of Redhill; Mr. W. A. Humphrey, of York; Mr. J. Powell, of East London, Cape Colony; Mr. F. W. Talbot, of Farnborough; Mr. W. A. Valon, of Ramsgate; and Mr. C. L. N. Wilson, of Bilston. Mr. J. H. Teague, of Lincoln, was transferred from the associate to the member class.

Associates.—Mr. J. H. Parkin, of Kendal; and Mr. H. C. Rawsthorne, of Bolton.

WATER SUPPLY FROM THE LOWER GREENSAND AT LEIGHTON BUZZARD.

Mr. H. BERTRAM NICHOLS, Assoc.M.Inst.C.E., read a paper on the above subject, and it produced a long and interesting discussion. The principal portions of the paper and a report of the criticisms upon its contents will be given in another issue of the "JOURNAL."

A hearty vote of thanks was accorded to the author; and this concluded the proceedings.

Water Supply for Lincolnshire Villages.—At the monthly meeting of the Sleaford Rural District Council on Monday last week, Dr. Giles reported outbreaks of typhoid fever at Helpringham and Billinghay; the latter being due to polluted water. Complaints were received that Billinghay, with 1200 inhabitants, had no proper public water supply. Eleven tenders were received for carrying out the Great Hale water-works scheme; that of Mr. Skinner (Heckington), for £635, being accepted. The Council resolved to borrow £1000 to carry out the works. Dr. Ashby reported that he had analyzed the Great Hale water, and found it perfectly pure.

The Ashburton District Council and the Gas-Works.—Opposition of a somewhat unexpected character has been displayed to the proposal of the Ashburton District Council to buy the local gas-works. As the result of negotiations the Council decided to give the Gas Company £2500 for the works, and, on the advice of Mr. H. A. Willey, to spend £900 upon improvements and extensions. Application has been made for permission to borrow the sum of £3400. A public meeting to consider the scheme was held yesterday week. The Portreeve (Mr. J. H. Foaden), who presided, expressed the opinion that the Council had acted in the interest of the town; and Mr. J. P. Tucker, the Chairman of the Gas Committee, contended that the works would yield a profit. Mr. Michelmore considered that the Council were paying too much. Fifty years ago, he said, the capital of the Company was £1400; and now, after all this time, they were to be paid £2500 for the works. Mr. Millman, while not entirely opposed to the purchase, criticized its terms, and suggested that the Council should revise them. Mr. Lamason contended that the works were dilapidated, and that, owing to their position, they were incapable of extension; while the fact that the Company had no Act of Parliament should be considered. A resolution was passed approving of the action of the Council, but expressing the opinion that the amount to be paid was excessive, and demanding a poll of the town on the question.

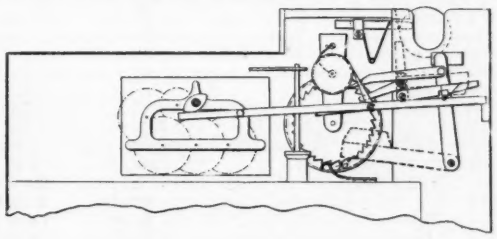
REGISTER OF PATENTS.

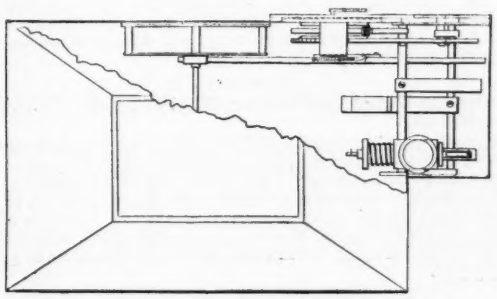
Producing Acetylene.—Goulding, F., of Great Harwood. No. 18,128; Aug. 3, 1897.

There is attached to the outer end of an arm projecting horizontally from the upper part of a gasholder bell the top end of a vertically disposed pipe, which passes through a stuffing-box in the bottom of a cistern containing water automatically supplied to it through an ordinary ball-tap; the vertical pipe being continued downwards, so as to enter a stand-pipe of somewhat larger diameter, and open to the air at its upper end. The vertical pipe has a small hole drilled into it, so placed that, when the holder drops, the hole sinks below the water-level in the cistern, and so admits water into the pipe to find its way into the generating chamber; but when the supply of gas to the holder causes the bell to rise, the supply of water to the calcium carbide is stopped, and the generation of the gas ceases until water is again admitted. The stand-pipe into which the vertical sliding pipe from the water-cistern is introduced communicates with the interior of the generator; a back-pressure valve being employed for the purpose of preventing any escape of gas from the generating chamber into the water-pipes.

Prepayment Meters.—Harrison, H. T., of Victoria Street, Westminster. No. 25,336; Nov. 1, 1897.

This invention relates more particularly to meters so constructed that it is only necessary to insert a coin in order to obtain its equivalent in gas—the turning of a handle, or the pulling of a knob or trigger, or other operation at the time of inserting the coin, being dispensed with.





As shown in the engraving, the coin is caused by its periphery to bear against and move idly to one side a lever, which, after the passage of the coin, returns under the action of a weight or spring to its original position. In this way, it actuates to a predetermined extent the apparatus for controlling the delivery of the gas.

In connection with the coin-lever, there is a locking device adapted to be operated by the coin so as to unlock the coin-lever and permit it to be operated as described. But, to prevent the coin being fraudulently withdrawn from the coin-shoot after being used to operate the lever, there is provided at a point between the free end of the lever and the outer end of the shoot, a stop device which moves and permits a coin to enter, but will prevent it being pulled out again.

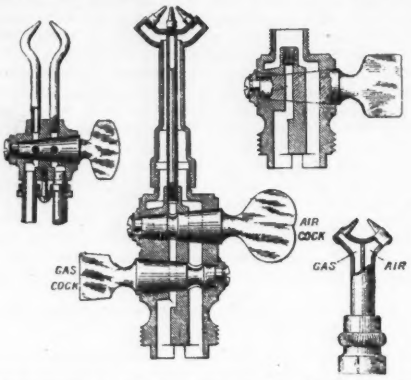
Producing Acetylene.—Arkell, G. E., of Cullingworth, and Bailey, J. W., and Clapham, J., of Keighley. No. 26,269; Nov. 11, 1897.

The main features of novelty in this generator are the arrangement whereby the water employed for removing the impurities from the gas is afterwards used for hydrating the calcium carbide; and the means whereby the flow of water for acting upon the carbide is regulated and controlled. These objects are attained by employing at least three vessels or containers, fixed at different levels, and connected by pipes and valves; and a carbide holder and regulator. The acetylene as generated passes through the regulator and forward into the holder, which rises and transmits motion to the valves until the gas within it is reduced. It then descends, on which it again operates the cocks, and more gas is generated. These simultaneous operations of the valves insure the regulator or intermediary vessel being kept supplied with an approximately even quantity of water; and by the gas being conducted through this vessel, it is constantly meeting fresh water so as more thoroughly to free it from impurities and better cool the gas before it enters the holder. All the impurities thus collected by the water are allowed to flow back into the generator, so as to be carried away with the spent carbide or refuse.

Burning Acetylene and Other Rich Gases.—Fraser, A. C., of Brooklyn, U.S.A. No. 27,016; Nov. 18, 1897. Date claimed under International Convention, April 19, 1897.

This invention provides for making a mixture of acetylene or other rich gas with air or oxygen. The admixture takes place in the flame by conducting the gas and air under equal or proportionate pressures to the burner, and discharging them therefrom in minute jets directed so as to impinge upon one another, and "thereby spread the gas and air into an extremely thin film of mixed gas and air." By this means, the patentee claims to attain "not only the advantages of the fish-

tail burner in spreading the gas into so thin a film as to afford a large surface for contact with the surrounding air, but also the same advantage as if the acetylene and air were previously mixed together, while avoiding the danger that is inseparable therefrom of forming an explosive mixture in the storage vessels and pipes."

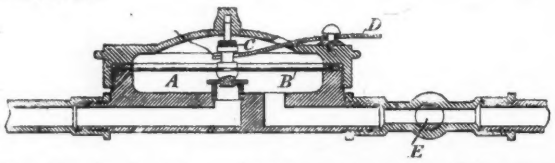


In one arrangement of burner, there are (as shown) two ducts or conduits (one for gas, the other for air), terminating in jet-apertures which are directed to impinge at a suitable angle, as in a fish-tail burner. The ducts are put into communication (through a cock) with two pipes—one communicating with the acetylene supply, and the other with the air; and the relative pressures may be controlled or governed in any suitable way whenever either is in excess of a proper ratio between the two. Another construction of burner has a plurality of jet-apertures, preferably three, of which the two outer ones discharge jets of air against each other, while the middle one discharges gas in a stream between the air jets.

An important advantage resulting from this improved burner is said to be that the burner-tip is kept cool by the jets of air, so that it is always below the igniting temperature of the acetylene. The carbonization of the latter so as to choke its jet-orifice is thus prevented. In fact, says the patentee, the issuing jets of air serve to cool the acetylene, and prevent it quickly rising to igniting temperature, with the result that the gas does not ignite immediately at the nozzle, but at some distance beyond the burner-tip. Especially with a tri-jet burner is the gas efficiently cooled between the two converging jets of air, which serve to blow the flame away from the burner-tip, and thus prevent the gas igniting at or close to the jet-orifice.

Self-Closing Gas-Burner Valve.—Thorp, T., of Whitefield. No. 27,214; Nov. 20, 1897.

This valve (for use chiefly on the gas-piping between the main or service supply-cock and the gas-burner) has for its chief object to prevent the escape of gas at the burner upon the turning on of the supply, in the event of the burner-tap being inadvertently left open at the time of the turning off of the supply. Its secondary object is to provide a valve which is self-closing with the turning off of the supply of gas to it, and which is opened at will and remains so when there is the usual pressure of gas in the supply-pipe.



The valve-chamber A has an inlet from the gas-pipe and an outlet to the burner; the former being of the same size as the bore of the burner-cock, and arranged preferably in the centre of one of the sides of the chamber. The side of the chamber opposite to the inlet or valve seating is formed of a flexible diaphragm B of considerable area compared with the inlet-orifice. It is under a slight pressure from a spring C (or its equivalent), so that the diaphragm, which has a valve-face connected to it, rests over the orifice formed by the seating, and a considerably greater pressure than exists in a gas-pipe is required to lift it. The diaphragm is provided with means by which it, and the valve carried by it, can be drawn away from the orifice. To this end, the piece forming the valve-face is also made with a neck, above which is mounted the spring, held in position by a screwed nut. A finger D has its inner end formed to grasp the neck, and is arranged at its outer end to come in contact with a cam on the tap E, the turning of which raises or lowers the finger.

With this apparatus, the gas can be turned off at the meter while the burner-tap is open; and the diaphragm or valve will be pressed against the orifice by the spring or weight. There being no pressure inside the chamber, and the orifice being small, it remains closed when the meter-tap is again turned on, so that no escape of gas takes place through the open tap. When the gas is to be lit, it is necessary to draw the diaphragm back by means of the finger D, when the gas pressure, acting upon the whole area of the diaphragm, prevents the closing of the orifice as long as the gas is turned on at the meter.

Nozzles for Bunsen Gas-Burners.—Seiler, M., of Berlin. No. 27,720; Nov. 25, 1897.

This invention of "gas-nozzles for bunsen burners" (more especially of the kind employed for the incandescent light) has for its object to facilitate the regulation of the flow of gas to the burner by the insertion in the nozzle proper of a small valve as near the top as convenient, and provided on both sides with flat surfaces, in such manner that, when the valve is turned, equal channels are formed on both sides of the valve, allowing two uniform gas-streams of comparatively small diameter to pass. The gas on entering the nozzle is retarded in speed; and in consequence of the larger surface of the nozzle, it expands and mixes thoroughly and violently with the air. The air and gas mixture thus obtained enters the burner at the right speed, or, more precisely (as the patentee points out), at a reduced speed, and thus produces the required blue flame.

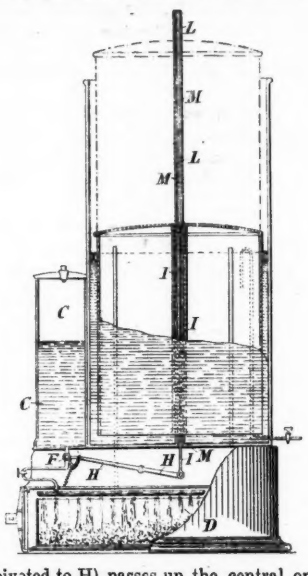
Gas-Mantles.—Smith, W. B., of Chelsea, S.W. No. 29,767; Dec. 16, 1897.

The patentee points out that in patent No. 2110 of 1890 is described "an ordinary incandescent or non-conductor, coated with an oxide or oxides that are better heat conductors;" but instead of coating the ordinary incandescent with the heat conducting oxide, he proposes to mix or combine the two together and spread the mixture upon a framework made of the ordinary incandescent or non-conductor, or "of a substance that may be a greater or less conductor of heat." By the words "ordinary incandescent or non-conductor," he means oxides of aluminium, magnesium, potassium, and silicon—one or more of these being used. By "heat conducting oxide or oxides," he means the oxides of chromium, cobalt, and tungsten. One or more of these oxides, or their suitable salts, are mixed with one or more of the ordinary incandescent oxides or the suitable salts "without or with other refractory substances used in incandescent mantles." The patentee also proposes to make mantles from a solution containing a mixture or compound of aluminium and chromium salts or oxides, with or without other refractory substances used in incandescent mantles. In mantles where thorium oxide is used, he also employs chromium oxide either in the manner already described (the thorium oxide being treated as the ordinary incandescent) or as in patent No. 2110 of 1890.

Producing and Storing Acetylene.—M'Conechy, J., of Glasgow. No. 30,585; Dec. 28, 1897.

In this apparatus there is an arrangement of a vertical lever working in a central passage or opening formed in a gasholder, which, when the holder falls to a certain determinate level, is acted upon by a bridge-piece, formed at the top of the holder, so as to operate certain levers in order to admit a supply of water to the gas-producer.

In the engraving, a pressure-pipe connects the reservoir C with the gas-producer D, so that the pressure in both vessels is the same. This causes the flow of the water. The lever H, which connects the upright or vertical lever I, operates the stopcock F, by means of a quadrant; or the arm of the valve may be formed with a toothed quadrant, engaging with a corresponding quadrant formed at the end of the lever. The



lever I (which is pivoted to H) passes up the central opening or tubular passage formed at the holder, and terminates with a rounded head or button, which is engaged by a bridge-piece formed at a central point of the dome of the holder when the holder is at nearly its lowest position. The bridge-piece works in a groove or longitudinal slot L, formed on either side of a funnel M, which rises centrally out of the bottom of the tank, and is so constructed that the groove or slot L is always above the level of the water in the tank, and therefore the water is not capable of escaping by this passage. When the valve F or the accumulator C has been turned on by the fall of the holder, and the quantity of water admitted to the producer has been such as to generate a sufficient volume of gas to raise the holder, the water is turned off by the action of a powerful spiral spring drawing down the quadrant, and at the same time raising the vertical lever I ready to be again acted upon by the fall of the holder.

Treating Carbide of Calcium.—Yvonneau, C. E., of Paris. No. 30,833; Dec. 30, 1897.

The patentee describes a novel manufactured product termed "safety carburet," consisting of a homogeneous mixture of a glucose and a fatty body at a temperature of about 100° C. in certain proportions; such mixture being combined with an alkalino-earthy carburet reduced to small fragments, and raised to a temperature of about 300° C. The whole is then heated for a period of time sufficiently to form a paste which may be moulded and compressed into solid bodies, which are covered with a "hydrofuge" substance. To prepare the carburet, 16 parts of glucose or a similar body and 4 parts of a fatty substance (such as any suitable oil) are heated in a receiver by steam to about 100° C., and mixed so as to form a perfectly homogeneous product. Next there is heated in a suitable receiver 80 parts of calcium carburet, previously broken into pieces of from about 2 to 4 mm. each, to a temperature of about 300° C. Then the small fragments of carburet thus heated are transferred to a mixture of glucose and oil, or similar bodies, having undergone the treatment

described in the first place, which mixture is maintained in a state of ebullition at a temperature approximating 100° C.

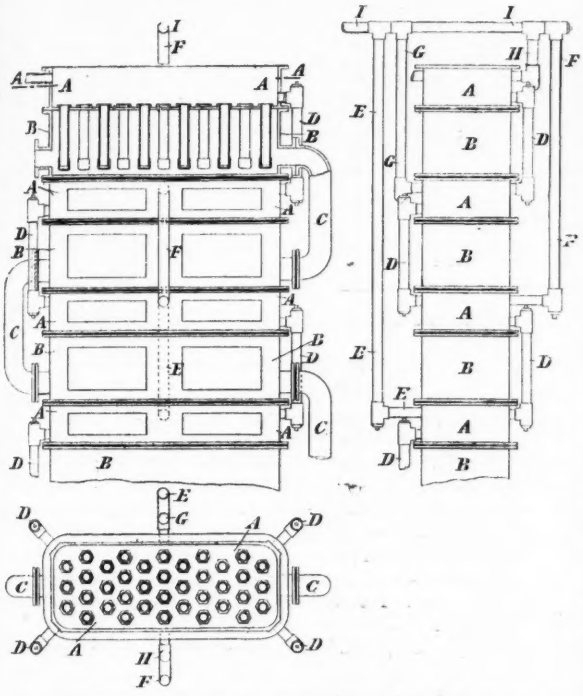
The fragments of heated carburet combine chemically with the mixture previously prepared; and there sets in a keen reaction which gives rise to a new body, the chemical formula (Ca_4C_9) of which differs from that of ordinary calcium carburet in that it contains a larger proportion of carbon. The reaction which takes place in the process of forming this body may be accounted for by the partial decomposition of the saccharine matters and oil at a high temperature; the intensity of the reaction having the effect of partly dissolving the sugar molecules into carbon, which becomes fixed in the nascent state upon the calcium carburet already formed. Thus—

$$4Ca_2C_2 + C = Ca_4C_9$$

Being in the condition of a paste, this product may be moulded and compressed into any desirable form; and it is then steeped in a liquid so as to become covered with a coating which, when dry, will form a sheath enveloping each fragment and protecting it from the action of moisture.

Sulphate Plant on the Continuous System.—Carr, I., of Widnes. No. 16,978; Aug. 6, 1898.

The object aimed at by the patentee is "to utilize and apply to a fuller extent, in the process of the manufacture of sulphate of ammonia, the heat of the hot waste gases from the saturator—that is, to utilize such heat in the superheating of the ammoniacal liquor prior to its entrance to the stills of the plant, and to economize fuel and plant." The superheater is so arranged that "practically the whole of the heat of the waste gases may be utilized in the superheating of the liquor, as well as obviating the necessity of the use of large or additional condensing plant in order to cool the waste gases prior to their treatment in the oxide purifiers or sulphur recovery kilns."



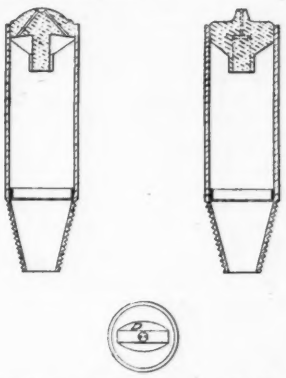
In the engravings, A are the upper or liquid chambers of a pair of chambers; and B are the lower waste-gas chambers. C are the pipes connecting the successive chambers B together in a pile; and D are the pipes connecting the successive chambers A. The number of chambers and size of superheater are considerably larger than those commonly employed. Thus a large heating surface and action are provided; and the gas is given off not only in the uppermost liquor chamber A, but also in the second, or second and third, or others, of these chambers, and taken away from each of them by a separate take-off pipe. For instance, as shown, the superheater is so arranged that gas which may be generated in the upper four of the liquor chambers of the pile is taken off by providing the pipes E, F, G, and H, which lead into a common main-pipe I communicating with the stills. Hence, in action, any gas that may be given off in the fourth liquor chamber from the top is freed from the liquor, and passes away by the pipe E to the still, without interfering in any way with the upflow of liquor through the connecting branches D. In the same way, the gas generated in the other three chambers above is provided for and carried off.

The liquor is heated in pipes fixed in the diaphragm between the chambers A and B; the ends being closed by caps. With the pipes arranged as shown, a large surface is exposed to the action of the heating gases as they pass through the chambers B. The pipes for relieving the chambers A, and the liquor flow pipes D, are so arranged, as regards the levels at which they lead into and out of the chambers, that the gas alone can pass off, while the liquor keeps in the correct course of flow from tier to tier to the final outlet.

It will, says the patentee, be seen that "by employing a superheater having a comparatively large number of chambers or a large heating surface, the whole heat of the waste gases from the saturator can be transferred to the liquor being supplied to the stills, and thereby a saving in fuel for volatilizing or distilling it is effected; also by reducing the temperature of the waste gases, the necessity of employing additional condensing plant is obviated." A further effect is obtained—namely, that by the long and continuous heating afforded by the apparatus, it is suitable for the decomposition and conversion to ammonia of a portion of the cyanides in ammoniacal liquor, when the latter has previously received an admixture of alkaline solution.

Gas-Burners.—Bray, G., of Leeds. No. 21,197; Oct. 8, 1898.

This invention relates to union-jet burners, designed for burning acetylene gas. As ordinarily constructed, these burners would be of such diameter as to interfere with the combustion of the bottom portion of the flame, and allow of carbon being freely deposited thereon; while the comparatively large area of the top of the burner would prevent that free access of air to the bottom of the flame which is necessary to the satisfactory combustion of acetylene gas.



To avoid these defects, the patentee proposes the form shown—a burner having raised on its surface a narrow ridge, on the apex of which is formed the small cup, within which the holes are pierced or drilled which convey the jets of gas to the point where they unite to form the flat flame. Such a burner raises the flame above the main portion of the top of the burner, and permits more free access of the atmosphere to the under part of the flame, and thereby to a large extent prevents the deposit of carbon on the top of the burner, and admits of the carbon that is deposited being easily removed. Also, "by permitting more free access of the atmosphere to the under part of the flame, the edges of the flame are made thinner and more luminous, and have less tendency to smoke."

APPLICATIONS FOR LETTERS PATENT.

25,030.—Bingham, C., "Carburetting." Nov. 28.

25,044.—Milne, J., and O'Connor, H., "Coin-freed gas-meters." Nov. 28.

25,051.—Gillespie, C. A., "Combined pressure or vacuum registers and electric alarms." Nov. 28.

25,079.—Crawford, M., "Burners for heating and lighting." Nov. 28.

25,118.—Thwaite, B. H., "Treatment and utilization of coke-oven gases." Nov. 29.

25,158.—Shillito, T. R., "Recovering sulphuric acid and sulphuric anhydride from gases." A communication from The Actiengesellschaft für Zink-Industrie vormals Wilhelm Grillo and Max Schroeder. Nov. 29.

25,160.—Barnett, C., "Production of acetylene gas." Nov. 29.

25,163.—Nodder, J. & T. H., "Locking cocks or taps." Nov. 29.

25,168.—Langhammer, A., "Automatic cutting-off valves." Nov. 29.

25,199.—Rammoser, A., Röhrs, E., and Röhrson, H., "Automatic igniters for incandescent and the like gas-burners." Nov. 29.

25,209.—Pilous, E., Ottermann, G., and Nauheim, E., "Producing gas from town refuse and sweepings." Nov. 29.

25,227.—Thubron, D., "Generators for acetylene gas." Nov. 30.

25,258.—Harrison, P., "Generators for acetylene." Nov. 30.

25,268.—Rammoser, A., Röhrs, E., and Röhrson, H., "Process for producing automatically igniting mantles for incandescent burners." Nov. 30.

25,277.—Boult, A. J., "Manufacture of water gas." A communication from G. Nicolini. Nov. 30.

25,291.—Aubertin, N. A., "Acetylene gas apparatus." Nov. 30.

25,297.—Bucher, P., "Apparatus for generating acetylene gas." Nov. 30.

25,298.—Woodward, J., "Unloading, heaping, stocking, or storing and loading coke, coal, and other materials." Nov. 30.

25,317.—Dillberg, G., "Acetylene and similar gas-generators." Nov. 30.

25,339.—Redman, T., "Atmospheric gas-burners." Dec. 1.

25,368.—Watts, C. J. & C. E., "Acetylene lamp or generator." Dec. 1.

25,369.—Boult, A. J., "Compressed gas-lighting installations." A communication from L. H. Karger. Dec. 1.

25,382.—Roberts, G., "Taps or cocks." Dec. 1.

25,449.—Rodwell, W. J., "Generation of acetylene." Dec. 2.

25,452.—Smith, H. E., and Doman, W., "Acetylene gas-generators." Dec. 2.

25,493.—Haddan, H. J., "Regulating the gas generation in acetylene or the like lamps." A communication from A. Frank. Dec. 2.

Grand Junction Water-Works Company.—In the report of the Directors of this Company, to be presented at the meeting to-morrow, they state that during the half year ending the 30th of September there was considerable progress both in the number of houses laid on and in the quantity of water supplied by meter for trade purposes, with the satisfactory result that the water-rental shows an increase of £3482 over the corresponding period of 1897. The Directors recommend a dividend at the rate of 7½ per cent. per annum on the £50 "A" shares, on the £25 "B" and "C" shares, and of 7 per cent. per annum on the £50 "D" shares, together with interest and dividend, in accordance with the conditions of sale, on the 600 new £50 "D" shares offered to public auction on the 18th of May last.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Carburation of Coal Gas.

SIR,—While thanking Mr. Young very much for his last letter on this subject, I am afraid I cannot accept his theories of scrubbing the gas, and criticisms on the process as being correct, because they are not borne out by the practice; and I still think that if Mr. Young saw the apparatus at work, his views would be considerably modified. Nearly all the points raised in Mr. Young's letter are dealt with in the paper read before the Institution of Gas Engineers in 1897, regarding which I also would refer Mr. Young to Appendix VIII., on the "Solubility of Naphthalene."

I was not aware of the Beilby process. But it is, of course, common knowledge that passing coal gas through, or washing gas with, petroleum will deprive it of some of its hydrocarbons; and a *spray*, however fine, will have proportionate effects. But a *mist* or fog, produced as in our process, is quite a different matter, as experience has proved; and whether those engaged in the gas industry credit the suggested theory of artificial vapour tension or not, it is none the less true that similar effects are produced, and I cordially invite Mr. Young to investigate it here for himself. It also may be that the mist or fog acts in some way as a lubricant on the sides of the mains.

The broad facts remain that suitable oils such as we use, if sprayed or squirted into the gas, not only would lower the quality, but have no effect on naphthalene, except locally; whereas the same oil, if converted into mist, travels with the gas through the *whole* canalization, without deteriorating the gas, and prevents naphthalene depositing. Similarly, other lighter oils which are eminently suitable for carburetting purposes, are of no use when employed for our process of *carburation*. The results show that, although the process is applied to the gas in motion, little of the scrubbing effect expected by Mr. Young is experienced in actual practice; and I believe the result may partly be expressed in his words, that the part of the mist which is put "into the gas in a sufficiently fine state of mechanical division to accompany the gas through the burners and add to its luminosity, is greater than the illuminating value of the hydrocarbons (naphthalene, &c.) which have been removed or dissolved from the gas by the less perfectly atomized portion of the mist." The only qualification I should wish to add to this is that experience has shown that, if hydrocarbons are precipitated, the amount is too small to be evident.

Hastings, Dec. 10, 1898. CHAS. E. BOTLEY.

Prepayment Meters.

SIR,—Mr. Nasmith's letter in your issue of the 29th ult., and Mr. Marsh's in yours of the 6th inst., are both on one subject, and may be replied to together.

I at once express my regret to these gentlemen that, quite inadvertently, I omitted to mention their patents. As a matter of fact, I intended to say very little about automatic meters and the many patents; but the subject grew, and suggestions were made as to the advisability of extending the scope of the articles to include a brief notice of the various early-pattern meters. I felt that, as regarded master patents, I was perhaps "Rushing in where angels feared to tread;" and so it appears, from the letters under review. My omission will perhaps be condoned, however, when I remind Mr. Nasmith that I sent him a proof of the article in question; and he assisted me by correcting the spelling of his name, and pointing out that Wallace's patent did not contemplate or cover the supply of gas.

I am glad to have this opportunity of thanking Messrs. Nasmith and Marsh, and many private friends, for their appreciative remarks respecting my humble efforts; and I should like to again point out that the articles have been chiefly compiled from *public references*, either at gas managers' or gas companies' meetings, and consequently do not mention the practice of many towns whose enterprise in the direction of free slot-cookers is worthy of emulation.

It has been suggested that the articles should be reprinted; and in the event of this being done, I hope to give a fairly complete survey of the practice throughout the country.

E. W. T. RICHMOND.

132, *Queen Victoria Street, E.C., Dec.* 7, 1898.

The Purchase of Coal and Reduced Production of Gas at Rotherham.—The coal contracts question again cropped up at last Wednesday's meeting of the Rotherham Town Council. It may be remembered that at the July meeting there was a rather prolix discussion on the subject, which ended in the Council purchasing a quantity of coal for gas-making purposes beyond the recommendations of the Gas Committee. Last Wednesday, Mr. Gichard was anxious for an explanation as to why the make of gas per ton of coal in October was 10,297 cubic feet, as against 11,390 in the corresponding month of last year. To this Mr. Gummer replied that it was partly owing to the introduction of new men who did not understand the machinery, and partly to the Corporation having bought coal on other than commercial principles. Alderman Mill regarded the latter statement as a serious reflection on the members of the Council, and thought it should be withdrawn. Mr. Gummer said he had nothing to withdraw. People would not purchase in private business what they did not require. Alderman Mill considered this remark cast a serious reflection on the whole Council, and put Mr. Gummer's judgment as being superior to that of the majority of the members. The Mayor (Mr. F. Mason) did not agree with Mr. Gummer as to the purchase of the coal being otherwise than upon commercial principles. Mr. Gummer might not concur in the decision of the Council; but he (the Mayor) felt sure that every member of the Corporation dealt with the business of the town in the same manner that he would in his private capacity. As Mr. Gummer was entitled to hold to his own opinion, he (the Mayor) could not call upon him to withdraw. Mr. Copley expressed the hope that a better production of gas per ton of coal would be obtained in the future when the men got into the work. Mr. Hirst was much amused at the way in which the various members of the Gas Committee flattered themselves in regard to the conduct of the business of the department. He wished they would let the town have better gas and less talk. The subject then dropped.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Wednesday, Dec. 7.

(*Before Lords Justices* A. L. SMITH, RIGBY, and COLLINS.)

Southwark and Vauxhall Water Company v. Hampton Urban District Council—The Rating of Reservoirs.

This was an appeal by the defendants from the judgment of Justices Wright and Darling, on the 10th of March last; the question being as to whether a large reservoir belonging to the Company was "land covered with water" within the meaning of section 211 of the Public Health Act, 1875, and therefore entitled to be rated only at one-fourth of the net annual value. The Justices of Middlesex held that the reservoir ought to be rated at the full value; and from this decision the Company appealed to the Queen's Bench Division, who held, on the authority of several decided cases, that the reservoir was "land covered with water." (See "JOURNAL," Vol. LXXI., pp. 656, 724.)

Sir EDWARD CLARKE, Q.C., and Mr. COURTHOPE MUNROE appeared for the District Council, the present appellants; Mr. CRIPPS, Q.C., and Mr. RYDE represented the respondents.

Sir E. CLARKE occupied the whole of the afternoon with his argument, and was followed next morning by Mr. MUNROE; their endeavour being to show that some of the previous cases were decided on a different Act of Parliament, while others had been impugned to some extent by a more recent decision in the House of Lords.

Mr. CRIPPS did not address the Court for more than a few minutes; the point of his observations being that the cases cited on the other side had no bearing on the real question at issue, which was simply whether a reservoir was or was not "land covered with water."

Mr. MUNROE having added a few words in reply,

Lord Justice A. L. SMITH, in giving judgment, went through and commented upon the cases cited, and said there were three decisions as to what was meant by "land covered with water" given before the Act of 1875 was passed; and it must be assumed that the Legislature, in that Act, intended the same meaning to be attached to them. A Court of Law could not assume that some different meaning was intended. The appeal must therefore be dismissed, with costs.

Lords Justices RIGBY and COLLINS concurred; the latter adding that not only did he agree that they ought to follow previous decisions, but did not see how any other conclusion could have been come to under the plain terms of the Act of Parliament.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Dec. 9.

(*Before Mr. Justice* ROMER.)

The Best Incandescent Gas-Share Syndicate, Limited, v. The Incandescent Gas-Light Company, Limited.

This action and a cross-action—the first being to restrain threats by the Incandescent Gas-Light Company, and the second by the latter Company to restrain infringement by the former—came before the Court on a motion by the Best Syndicate to rescind an order made in chambers staying the action for infringement until the Syndicate had delivered twelve mantles, such as they proposed to manufacture, to the Incandescent Company for the purpose of analysis. It should be added that the motion was brought on some time ago in the ordinary way; but, as it appeared to involve rather intricate questions, his Lordship directed it to be placed in the list of non-witness actions, and it was only reached to-day.

Mr. BOUSFIELD, Q.C., and Mr. FROST appeared for the Best Syndicate; Mr. WALTER (in the absence of his leader, Mr. FLETCHER MOULTON, Q.C.) for the Incandescent Gas-Light Company.

Mr. BOUSFIELD commenced by giving a *résumé* of the numerous proceedings which had been taken, as reported from time to time in the "JOURNAL." The Incandescent Gas-Light Company issued circulars setting forth that anyone except the Sunlight Company making or selling incandescent mantles not of their manufacture were infringers, and would be proceeded against. The Best Syndicate started an action, and moved before Mr. Justice Stirling to restrain the issue of such threats; they having purchased a patent taken out by Mr. S. H. Croeker for the manufacture of mantles of thorium and scandium, which they alleged would not infringe the Welsbach patent. When the motion came before Mr. Justice Stirling, the Incandescent Company at once said they would commence an action for infringement; and thereupon the threats action was stayed. The action for infringement was before Mr. Justice Romer; and the threats action had been transferred, so that both should be before the same Judge. The plaintiffs in the infringement action had applied for an order that the Best Syndicate should supply them with twelve mantles such as they proposed to make and sell, for the purpose of analysis. But the defendants said they could not do so, on the grounds that they had not commenced the manufacture, and could not until the action had been tried; and that it was impossible to obtain pure scandium (which was the important ingredient) at any reasonable price, unless a large quantity, such as would be required for manufacturing purposes, were ordered. They offered, however, to furnish twelve mantles if the plaintiffs would undertake not to raise any objection on the ground of casual impurities being present. This offer was not accepted; the argument being that, if an effective mantle were made at all under Croeker's patent, its success would be due to the presence of some of the substances coming within the Welsbach patent, which it might be alleged were mere casual impurities. After considerable discussion had taken place,

Mr. *S. H. Croeker*, the patentee, was called as a witness, and stated that it was impossible to obtain scandium free from traces of other earths in such small quantity as would be required to make a dozen mantles.

In cross-examination, witness said he had never made pure scandium, but had heard of its being done. Professor Clevè had given the atomic weight of scandium, which he could not have done without having prepared scandium oxide. He was not aware that pure scandium could be purchased anywhere. He could manufacture mantles under his patent at a reasonable cost, if he could procure pure scandium.

Mr. Justice ROMER said, upon this evidence, he would discharge the order in chambers staying the action for infringement until the mantles were furnished, but would give the plaintiffs in that action leave to amend, in case it might be necessary. If the action were not now prosecuted with due diligence, the Best Syndicate might apply again. Meanwhile, the application for leave to go on with the threats action would stand over; and the costs of both applications would be costs in the actions.

RAILWAY AND CANAL COMMISSION.—Tuesday, Dec. 6.

(*Before Mr. Justice* WRIGHT, *Right Hon. Sir* F. PEEL, and *Right Hon. Viscount* COBHAM.)

Hackney Vestry v. East London Water-Works Company.

This was an appeal by the plaintiffs from the Registrar disallowing certain interrogatories.

Mr. BALFOUR BROWNE, Q.C., Mr. FREEMAN, Q.C., and Mr. BEVEN appeared for the plaintiffs; Mr. PEMBER, Q.C., Mr. CRIPPS, Q.C., and Mr. H. SUTTON represented the defendants.

Mr. BALFOUR BROWNE said he did not propose to read any portion of the interrogatories, which were very numerous and searching; but he should contend that the principle on which the Registrar had acted was a wrong one. The application was made under the Metropolitan Water Companies Act, 1897, section 1 of which provided that any water consumer or any local authority might complain to the Railway and Canal Commission that any of the Metropolitan Water Companies had "failed to perform some statutory duty;" and the Commissioners, if satisfied of such failure, might order such Company to fulfil the duty, and, if they thought fit, impose a penalty. The "statutory duty" alleged by the Vestry in the present case was to supply water under the constant service system. In answer to this, the defendant Company said that by their Acts of Parliament they were excused from giving such supply in the case of "unusual drought or other unavoidable cause or accident." The Registrar took the view that all the interrogatories were beside the matter, because the Company alleged "unusual drought or other unavoidable cause or accident;" and that the only issue was whether there was such a drought. The plaintiffs pointed to various matters which, if the Company had done them in proper time, would, they said, have avoided the necessity of a breach of the statutory duty to give a constant supply; and the Company were bound to do everything reasonable to enable them to perform their duty. The word "drought" was very indefinite. Drought might exist for five days or five months; but supposing it existed for five days, and immediately before it came on the Company let the whole of the water in their reservoirs run to waste, so that they were unable to perform their statutory duty, it was clear that, by neglect or default, they had put themselves in a position in which they could not perform it, so that the plaintiffs were entitled to ask the Court for an order compelling them to perform their statutory duty. The Registrar seemed to think that the only question was: Was there a drought? He ventured to think this was not sufficient. The words "unusual drought" were coupled with "or other unavoidable cause or accident." One could not avoid a drought, but could avoid the consequence of a drought; and this was a part of the statutory duty of a water company. As a matter of fact, they knew now that the defendant Company were providing more storage for the very purpose of having sufficient water to meet the requirements of a drought extending over a longer period than they were lately able to tide over. The question was whether the plaintiffs were unreasonable in saying that the defendants ought to have provided for the drought of 1898. When the case came on for hearing, the plaintiffs would show that, after the experience of 1893, the Company ought to have provided such storage as would have enabled them to tide over the dry season of 1898. After undue delay, the Company went to the New River Company and other Companies, and obtained water which they had been supplying ever since. In conclusion, he submitted that the plaintiffs were entitled to interrogate on the issues raised by them.

Justice WRIGHT said the view of the Court at present was that, in so far as the interrogatories went to the question of what storage capacity the Company's reservoirs had, what arrangements had been made with other Companies, and facts of that kind, they ought to be allowed; but the bulk of them appeared to be oppressive. If Counsel for the Company objected to answer these points, the Court would hear them; if not, the Court did not desire to do so.

Mr. SUTTON observed that the Registrar, after going through the interrogatories, thought that out of the 500 questions asked only about 10 could be properly put; and therefore he, acting on rules which were perfectly understood, disallowed them all. In each interrogatory there were about 14 questions. He did not say that there might not, here and there, be a proper question which should be answered.

Justice WRIGHT asked whether the parties were willing that he should go through the interrogatories and strike out what was immaterial.

Mr. SUTTON said he should be perfectly willing to leave the matter to his Lordship.

Mr. BALFOUR BROWNE also assented to this course being followed. In reply to his Lordship, he said he did not insist on the first 15 interrogatories.

Justice WRIGHT said, after looking at the interrogatories, he was not surprised that the Registrar took the course he did.

Vestries' Liabilities for Public Lighting.

In the Queen's Bench Division of the High Court of Justice last week, Mr. Justice Wills and a Special Jury had before them the case of *Thurrold v. The Vestry of St. George's, Hanover Square*, in which the plaintiff sought to recover damages for injuries to himself and a horse and hansom cab through the alleged negligence of the defendants. The plaintiff was driving a fare to Hyde Park Gardens on the 8th of March, about 8 p.m. When in Belgrave Square, he passed on the right-hand side of a refuge with the intention of going along Grosvenor Crescent; but just at that point his fare told him to go by way of Wilton Crescent. Thereupon he turned sharp to the left; and in doing so he drove very near the refuge, and the cab was upset by a heap of sand and gravel lying there. The gas-lamp near the spot was out at the time; and while it was admitted that the lamp was not under the control of the Vestry, the plaintiff contended that if they put the heap in the road they did so at their peril. The sand, which was required for wood paving, was now put in a tin bin on the pavement; and plaintiff said that there would have been no accident if this precaution had been adopted before. For the defendants it was contended that the plaintiff must show that the accident was brought about substantially by their negligence, and by that alone. Under the Metropolitan Management Acts, the Vestry had the duty of lighting the streets. They had made a contract with the Gas Company to do the lighting; and through no fault of either the Vestry or Company the lamp went wrong. It was submitted that there was no negligence in a gas-lamp being out for an hour; the defect having been remedied as quickly as possible. It was the duty of the Vestry to maintain the streets, and they had put the gravel where it could be most easily got at. Mr. Justice Wills said the question was whether the Vestry had taken all reasonable precautions to render the heap safe. If the place was not a fit one, there was carelessness. If the place was a fit one, but was not properly lighted, it was a question of negligence. He did not think the Vestry were in any better position by giving the lighting contract to the Gas Company. It was the duty of the Vestry to light the heap, and want of light was evidence of negligence. The Jury found that there was negligence on the part of the defendants, and that the plaintiff was not guilty of contributory negligence. They assessed the damages at £70. Upon these findings, judgment was entered for the plaintiff.

When Oil-Engines become Gas-Engines—Curious Patent Action.

The case of *The Valveless Gas-Engine Syndicate, Limited v. Day*, before the Court of Appeal last Wednesday, raised a curious point respecting patents. The defendant Day patented a gas-engine in 1891, and sold his rights to the plaintiff Syndicate by an agreement under which he also undertook to assign to them any improvements he might make on the patent. Plaintiffs claimed that an oil-engine patented by Day in 1895 should be assigned to them, as being an "improvement" on their gas-engine; but at the trial Mr. Justice Bigham gave judgment for the defendant. (See "JOURNAL," Vol. LXXI., p. 662.) The plaintiff Syndicate appealed. Lord Justice A. L. Smith, in delivering judgment, said beyond all doubt the chief mechanism of the gas-engine had been utilized for the oil-engine, with such modifications as the introduction of an oil-spray in place of gas necessitated. The introduction of an oil-spray to the engine was an improvement so far as that the engine could then be used in places where gas could not be obtained. Lord Justice Collins concurred. Lord Justice Rigby, however, dissented, holding that the oil-engine was not of the type to which the gas-engine patent alone applied, and the oil had no relation to it. Accordingly, by a majority, the appeal was allowed.

Theft from a Prepayment Meter.

At the Manchester City Police Court last Wednesday, James Furlong, a man of respectable appearance, was charged with stealing 4s. 1d. from a penny-in-the-slot gas-meter belonging to the Manchester Corporation. The meter was fixed in a house in Wardlowe Street. The prisoner, ascertaining that the people who lived in the house were out, borrowed the key, which had been left with a neighbour (to whom he stated that he was a Corporation collector), broke open the meter, and took the money. When he returned the key, the neighbour asked for an official receipt; and as he was not able to give it, a policeman was fetched. It was stated by the prisoner that he had a sickly wife and a number of children. He was sentenced to one month's hard labour. Incidentally, it was mentioned that there are 26,000 prepayment meters in use in the city, about ten of which are robbed every week.

Street Lighting at Plymouth.—In view of the early completion of the electric light works, the Corporation of Plymouth have taken over from the Gas Company the maintenance of the street-lamps and their lighting and cleaning. It has been decided to place the supervision of the whole of the lighting, whether by gas or electricity, with the Electric Lighting Committee; and Mr. J. H. Rider, the Electrical Engineer, will be the Lighting Superintendent.

The Transfer of the Filey Gas and Water Works to the Urban District Council has been completed, and the last payment to the Company made. When this was reported at last Tuesday's meeting of the Council, the Chairman (Mr. Maley) said he considered that it was one of the best investments on the part of the town that they had ever made. Messrs. Smith and Towse also spoke in congratulatory terms of the step that the Council had taken, and predicted that Filey would benefit through the undertaking changing hands.

Opposition to the Bedworth Gas Scheme.—Last Tuesday, a meeting of ratepayers, convened by the Bedworth Parish Council, was held to consider the advisability of taking steps to oppose the application for extended powers about to be made by the Bedworth Gas Company. Mr. W. Johnson, who presided, said gas had had its day in Bedworth, and the Council could set up an installation for supplying electric light at an initial outlay of £1500. Coventry was about to erect auxiliary gas-works at Foleshill, and that city might be induced to supply Bedworth more cheaply than the Bedworth Gas Company were doing. Mr. Brock-Harris assured the meeting that it would be ridiculous for Bedworth to attempt to set up an electric light station unless the parish was prepared to spend double or treble £1500. Mr. W. Linney moved a resolution authorizing the Council to obtain professional advice and assistance in the matter, and to charge the same on the rates. This was agreed to; and it was decided to seek the assistance of the Warwickshire County Council and Foleshill District Council in the matter.

MISCELLANEOUS NEWS.

BIRMINGHAM CORPORATION GAS AND WATER SUPPLY.

Progress of Prepayment Gas Consumption—The Recent Drought—The Welsh Water Scheme.

At the Meeting of the Birmingham City Council last Tuesday—the Lord Mayor (Mr. Alderman Beale) in the chair—the reports of the Gas and Water Committees, noticed in the "Journal" last week, were under consideration.

Mr. J. H. Lloyd, the new Chairman of the Gas Committee, in moving the adoption of their report, expressed regret that they had lost their Chairman owing to his disfranchisement, through gross carelessness in the preparation of the list of burgesses. Mr. Pollack, he said, had for 17 out of the 23 years the gas-works had been owned by the Corporation, taken the deepest interest in the work of the Committee; and for 15 years, except during his mayoralty, he had been the Chairman. During this time the output of gas had practically doubled, the works had been re-organized, and great progress had been made in every department. The consumption of gas continued to increase. For the half year ended Sept. 30, 1897, it was 13½ per cent. over the same period in 1896; and for the half year ended Sept. 30 last it was 3½ per cent. over 1897—being an increase equal to 8 per cent. in the two years. He referred at some length to the extension of the Saltley works, as detailed in the report, and as recently described in our columns (*ante*, p. 866); remarking that the total expenditure involved was about £470,000. He then alluded to the explosion which occurred at the works on the 13th ult., when two men were badly injured—one subsequently dying at the General Hospital. He praised the action taken by Mr. Morrison, the Superintendent of the works, on that occasion; and remarked that he had distinguished himself in a similar manner in December, 1889, when two men were killed. In recognition of Mr. Morrison's bravery, the Committee had awarded him £25. On the advice of the General Purposes Committee, they had not insured against accidents under the Workmen's Compensation Act; but the Committee had made a grant of £237 16s. 6d. to the personal representatives of the man who died. The prepayment-meter system was increasing in popular favour. In March, 1896, there were 1350 of these meters in use; in March, 1897, the number had increased to 2000; and by March 1 last the total had gone up to 3600. There were now 5200 at work, and 1000 orders were on hand. It was not unreasonable to suppose that by March 31, 1900, the number of prepayment meters in operation would be 10,000.

Mr. Hennessy expressed an opinion that the price charged for the hire of prepayment meters and fittings were excessive.

Mr. Toller said he could not see why Mr. Morrison should receive £25 in recognition of his bravery on the occasion of the accident, while the workmen who assisted only received £10 between them. He disapproved of the Committee making grants of this kind when accidents occurred, because it might be an incentive to cause accidents. Accidents in the gas-works could always be produced; and if a manager was to be paid £25 for every accident that occurred, he would say, "The more accidents, the more money I get." (Cries of "Oh, oh," and "Shame.") He considered the Council should do what they could to prevent accidents; and there was no doubt that if the machinery had been in proper working order this particular accident would not have occurred. He proposed, as an amendment, that £25 be distributed among the workmen instead of the £10 proposed by the Committee.

Mr. Jephcott seconded the amendment.

Mr. Lloyd, in reply, said the charge for the hire of prepayment fittings was very low, and he did not think it could be reduced. With regard to Mr. Morrison, the £25 was paid in consideration of his having saved the department so much by the prompt action he took. He (Mr. Lloyd) was surprised that any member of the Council should have suggested that such a man as Mr. Morrison would wish to have further accidents with the view of getting more money. If Mr. Toller would withdraw his amendment, the Committee would inquire into the matter, and ascertain what the men had done; and if it was thought they had done something for which the Committee could reasonably give them more than £10, they would do so.

Mr. Toller withdrew his amendment; remarking that it was not his intention to say the Manager would wish to have more accidents.

The resolution was then put and carried.

Alderman Lawley Parker, in moving the adoption of the report of the Water Committee, referred to the heavy expenditure necessitated for the provision of temporary works until the Welsh water scheme was completed. These works, details of which he gave, would require an outlay of £18,688. Referring to the bursting of a main at Whitacre in September last, he remarked that, though the fracture was a serious one, the main was repaired in 48 hours, and without any interference with the supply except in the local district. That the work was expeditiously done was shown by the fact that in 1894 a similar fracture took ten days to repair. Turning next to the recent drought, he said that the period of dry weather was necessarily an anxious time for the Committee. They had the greatest continuous drought they had ever experienced, so far as he knew; and, moreover, the rainfall for the last five or six years had been below the average. The reservoir at Shustoke was so low that if the drought had continued for another 20 days they would have been without any available supply from that source. The Committee had, therefore, to carefully consider their position; and it became a question whether they should not limit the supply by making it intermittent. In view of the fact, however, that very great inconvenience would be caused, especially to the small consumers and manufacturers, it was decided to go on for another ten days, and to rely upon the consumers doing all they could to lessen the quantity of water used. For the most part, they loyally helped the Committee, especially after attention had been called by the Press to the serious position of affairs; and there was a sensible diminution in the quantity of water used. There were, of course, some instances in which selfish consumers used the hose and spray on their lawns, and wasted the water at night; but, as a rule, the consumers were economical. Happily, before ten days expired the rain came—not in copious quantities at first, but sufficient to prevent any further inroad upon the small storage at Shustoke. Some people then thought the Committee were easy in their minds; but this was not so. There had been seven weeks of more or less broken weather; but now the water in the Shustoke reservoir was 3 ft. 7 in. below its normal level. During the recent wet weather, they had only regained something like 1⅓ inches per day; so that nothing short of two or three wet weeks would restore the supply. Not a word too much had been said in the desire to impress upon consumers the necessity for the strictest economy. They had been within measurable distance—a short distance—of water famine; and no one knew what this meant except those who experienced it. Unless they had a more plentiful water supply, or were able to add to the water they already obtained from the wells, during the next four years, they would be in very dire straits. The Committee had seen during the past year more strongly than ever the necessity for the Welsh scheme; and they longed for the day to come when they would be able to draw water from the Principality. With regard to the Elan supply, the aqueduct was making progress, and all the contracts were let except one. He had made a somewhat pessimistic speech; but there was a brighter side. The half-year's accounts showed favourable figures, and the increased rental was still well maintained; and if this continued, they would have a substantial provision towards the additional charge for interest and sinking fund on the extra capital likely to be expended in carrying through the scheme.

The report was adopted.

GAS v. ELECTRICITY FOR LIGHTING PUBLIC INSTITUTIONS.

The above subject has lately been ably dealt with by Professor Carlton Lambert, M.A., of the Royal Naval College, Greenwich, in an article contributed to "The Hospital." The author's name is well known to many of our readers as a lecturer on gas subjects; and therefore his remarks claim attention. As they are addressed to persons concerned more or less with the management of large public institutions, he begins by pointing out that the importance of a system of artificial lighting which shall be at once efficient, economical, and healthy, makes a study of the relative advantages of gas and electricity, in the light of modern developments, one of great interest to them. He goes on to say that were it not for the invention of Dr. Welsbach, who, in 1887, taught us how to obtain from a cubic foot of gas eight times as much light as we had been accustomed to get from our open burners, gas, as an illuminant, would have been "almost entirely out of the field at the present day." Be this as it may, there can be no doubt that, as Professor Lambert says, the Welsbach mantle has "effected a great revolution in artificial lighting, and has made gas absolutely unapproachable at present by its competitors as a cheap illuminant." He then proceeds to describe the mantle, and to give the results obtained with one of the ordinary "C" type; pointing out, however, that the Welsbach Company's new burner does very much better. His laboratory is at present lighted by one of these burners, which gives a light of 110 standard candles with a consumption of 4·8 cubic feet of gas per hour—an efficiency ten times as great as that of good ordinary fishtail or batswing burners. The meaning of this is that, with the South Metropolitan Company's gas at 2s. 3d. per 1000 cubic feet, he is getting light at the rate of 110 candles for nearly 7⅔ hours for one pennyworth of gas. Of course, as he is careful to point out, in a practical estimate of the cost of Welsbach lighting under every-day conditions, it will be necessary to make some deduction from these figures, and allow, not only for renewal of mantles, but for a gradual decline in their illuminating power. Assuming a lamp to be lighted for 1500 hours per annum, it is a good rule, he says, to allow for three mantles for this period, and to take the average life at 500 hours. During this time it is safe, in his experience, to expect an average efficiency of quite 14 candles per cubic foot of gas; so that one may rely upon getting a mean of 50-candle power at the cost of 3·6 cubic feet of gas per hour.

With these preliminary observations, Professor Lambert proceeds to cite a case to prove the advantages of the incandescent gas system. At the Yarrow Convalescent Home, Broadstairs, of which he is a Trustee, the building was originally planned for an electric light installation; but inquiry having shown that the use of the incandescent gas-light would result in a large annual saving, the electric scheme was abandoned, the engine, dynamo, and accumulator rooms were otherwise utilized, and 156 Welsbach burners were fitted up. During three years to the 30th of September last, accident and decay of the mantles had been covered by 704 renewals, or less than two per burner per annum. In the same period, the expenditure on other upkeep was less than 4d. per burner per annum. The dining-hall for 100 children and attendants, which has an area of 64 by 27 feet, has four triple gas-pendants with 12 Welsbach lamps and "Cosmos" opal shades. Three burners are found to illuminate the entire hall sufficiently for ordinary purposes, and usually no more are lighted. Under these circumstances, we are not surprised to learn that the economy and general results of the Welsbach lighting have given great satisfaction to the Trustees.

Professor Lambert says that careful domestic arrangements have probably made these results exceptionally favourable; and therefore, in the general estimate of the comparative cost of gas and electric domestic lighting which he is about to give, a somewhat larger cost of upkeep is assigned to the Welsbach system than has been incurred at the Yarrow Home. He then proceeds as follows: London experience of electric lighting, where the current is retailed at about 6d. per unit (1000 watt-hours), shows that a glow lamp absorbing 64 watts gives, when new, a maximum light of 16 candles. In consequence, however, of the gradual deposit of carbon from the filament upon the glass, the light value falls off, and an average of 14 candles is as much as should be expected during the useful life of a nominal 16-candle glow lamp. We will give the advantage, however, to the electric lamp, and credit it with 16 candles. When treating of the old system of open gas lighting, it is assumed that the best No. 5 Bray burners are used, giving, with London gas, an efficiency of 2½-candle power per cubic foot. This is a very generous estimate; the average efficiency of open burners in practice being more commonly 1½ to 2 candles, and the smaller sizes even less. With this explanation, the following table will give the relative cost, at London prices, of lighting an institution requiring a total light of 4000-candle power for 1500 hours annually with electric incandescent lamps, Bray burners, and Welsbach lamps.

Electric Incandescent Lamps.

250 16-candle lamps, each absorbing 64 watts; cost of current, at 6d. per unit.	£600
Renewal of lamps, 500 per annum, at 1s. 6d. each	37
Total	£637

Open Gas-Burners.

320 Bray's "Special" burners, each giving 12½-candle power for 5 feet of gas per hour; cost of gas, at 2s. 6d. per 1000 cubic feet	£300

Welsbach Incandescent Burners.

80 "C" burners, each giving 50-candle power for 3·6 cubic feet of gas per hour; cost of gas	£54
Renewal of mantles (240) and extra upkeep, 3s. 6d. per burner per annum	14
Total	£68

The writer acknowledges that economies can, of course, be effected in electric lighting by the use of 8-candle lamps in places where only a little light is required, and also by making the most of the facility afforded for turning the current on and off as required. But he says these advantages are almost entirely met in the Welsbach system by the new small lamps now being supplied, which burn only 1 to 1½ cubic feet of gas per hour, and by the almost universal use of the bye-pass burner. Making all due allowance, however, for some advantage which electric lighting certainly possesses in these and other respects, he thinks we cannot help being impressed by the broad deduction from the above table, that electric lighting is twice as dear as the old gas system, and nine times as dear as the Welsbach system. When the new incandescent burners are commonly adopted, the advantage of the latter system will be further enhanced.

Dealing further with the question, Professor Lambert endeavours to meet the cases of provincial institutions which have no access to public electric mains; and he gives the following estimate representing the cost of laying down an electric generating plant and installation of 300 16-candle lamps, and the annual outlay for the maintenance of the light, together with the cost of an equivalent of gas lighting:—

ELECTRICITY.

Outlay on Plant.

Gas-engine, 35 brake horse power	£300
Dynamo, 25 kilowatts	160
Accumulators	350
Lamps, switches, wire, fitting, &c.	275
Total	£1085

Annual Expenditure (1500 *Hours*).

Renewal of lamps, 600, at 1s. 6d.	£45
Depreciation and upkeep, 10 per cent. on £810	81
Labour	40
Gas and oil	110
Interest on plant, 4 per cent. on £810	32
Total	£308

GAS (WELSBACH INCANDESCENT BURNERS).

Annual Cost for Equal Light.

Gas at 2s. 6d. per 1000 cubic feet	£65
Renewals of mantles, &c.	17
Total	£82
If current had been supplied from electric mains at 6d per Board of Trade unit, the annual cost of electric lighting, including lamp renewals, would have been	£763

Having disposed of the objections raised to gas lighting that it causes vitiation of the atmosphere, and that the Welsbach system is trying to the eyes, Professor Lambert enumerates the chief instructions given to those who manage the Welsbach lights at the Yarrow Home, attention to which has, he says, conduced to the satisfactory results obtained there. They are as follows:—

1.—Do not leave the gas-tap full on, but turn it back until the best light is shown. The gas-flame should just fill the mantle. Any more gas burnt gives less light, and is only wasted.

2.—If a black deposit of carbon should form at the top of the mantle, this is either due to a dirty burner or to too much gas being burned. Turn the gas down till the flame only fills one-half of the mantle, giving very little light; the deposit will, in a few minutes, disappear by oxidation.

3.—When lighting a burner at the top of the chimney, wait a few seconds after turning the gas on, and before applying the light; this prevents shock to the mantle.

4.—Burners, especially in dusty rooms, sometimes get clogged by dirt and give poor light. When this is the case, carefully remove the mantle from the rod; take off the gallery, and blow vigorously through the gauze, or scrub it with a brush. Remove any dust also from the gas-nipple by blowing through the air-holes at the bottom of the burner; replace and re-light. This almost invariably results in a great increase in the light.

The article concludes with the following extract from the report, recently issued, of the Richmond Public Library Committee, who, upon the advice of the writer, have substituted incandescent burners for the regenerative lamps previously in use. He thinks it should encourage those who are contemplating the installation of Welsbach lights: "The adoption of the incandescent system of gas lighting referred to in last year's report has quite satisfied all expectations as regards increased cleanliness, superior quality of the light, greater purity of the atmosphere, and reduction in the amount of gas consumed. The saving in expense by the new system during the year 1897-8 amounted to £21 13s. 4d., or 32 per cent. of the previous year's cost."

The New Water-Works for Todmorden.—At a recent meeting of the Todmorden Town Council, it was decided to proceed at once with the construction of new water-works for the borough on the recently acquired site at Gorpley, in the Dulesgate Valley; and Mr. G. F. Deacon was appointed the Chief Engineer.

SALES OF STOCKS AND SHARES.

The largest room at the Auction Mart, Tokenhouse Yard, was filled to overflowing last Tuesday, when Mr. Alfred Richards, in accordance with instructions received from the Directors, offered for public competition £187,500 of ordinary stock of The Gaslight and Coke Company, issued under the provisions of the Company's Act of 1876, and of the Capital Consolidation Act of last session. The standard dividend on this class of stock will be 4 per cent. per annum, subject to the sliding-scale, under which, at the present price of gas, the authorized rate of dividend payable is £4 18s. per cent. per annum. The stock was put up in lots of £5, £50, £100, £250, £500, and £1000; and the whole of it was disposed of in less than an hour and a quarter. The highest price realized was £116 10s., and the lowest £110 10s., per £100 of stock—the average being £111 0s. 2d. On the day of the sale, the Company's old stock was quoted on the Stock Exchange at £285 to £290; but this was with the accrued dividend. As the new stock is not to be paid for in full or to carry dividend until the 1st prox., a full six months' interest should be deducted from the old stock in comparing the prices of the two. Deducting £6 2s. 6d., from the middle price gives (say) £281 7s. 6d.; yielding about £4 7s. per cent. for the stock carrying 12½ per cent. The proportionate price for the new stock would be about £112 13s.; and consequently the average realized at the sale, which was only about a point and a half below the market price of the day, may, in view of the large amount of capital being raised, be regarded as very satisfactory.

On Monday afternoon last week, Mr. M. Stainton sold by auction £8000 of new stock of the South Shields Gas Company. It was put up in lots of £100 each; the highest price realized being £212 5s., the lowest £207, and the average £208 10s. 11d. The sale produced £16,683 15s. Last Tuesday, Messrs. Kidwell and Son sold at Rochester 500 £5 shares in the Brompton, Chatham, Gillingham, and Rochester Water Company, at prices ranging from £10 6s. to £10 4s. each. The shares were a portion of the additional capital authorized by the Company's Act of the present year; the maximum dividend on them being 7 per cent. At the same auction, 29 fully-paid £5 "A" shares in the Company, bearing 10 per cent. dividend, fetched prices ranging from £15 5s. down to £15 per share. The sale of the second 1500 £5 shares of the 1898 issue of the new ordinary 5 per cent. capital of the Portsmouth Water Company took place last Tuesday evening, at the Southsea Sale Rooms of Messrs. Love and Cooper. The shares were offered in lots of five, the opening bid for which was £6 per share. The first five lots brought £7 5s. per share; then there was a drop to £7, followed by an increase to £7 2s. 6d., and again a run upon £7—about 60 lots being disposed of at this figure. The 141st lot went for £6 17s. 6d., and then £6 15s. was accepted; but the last 120 lots brought only £6 12s. 6d. The average for the whole was £6 17s. per share; and the total proceeds of the sale amounted to £10,240. On the following day, Mr. R. Reid disposed of 3000 £20 shares (7 per cent.) in the Eastbourne Water Company; being a further portion of the additional capital required for the works now in progress. The first 40 lots, consisting of five shares each, fetched £20 per share; and then the price gradually rose. But it declined afterwards to £22; the whole of the remaining lots being rapidly disposed of at par. On Thursday, two £100 debentures of the Wellington (Salop) Gas Company were sold for £150 each, which is regarded as a record price. Some 10 per cent. shares in the Salisbury Gas Company were recently sold for £26 each; and some 7 per cent. shares for £17 apiece.

ELECTRIC LIGHTING NOTES.

The Hastings Town Council have received sanction from the Local Government Board to borrow £58,000 for purchasing the undertaking of the Hastings Electric Light Company, Limited.

Colonel A. J. Hopper held an inquiry at Rochdale last Wednesday respecting an application on the part of the Corporation to borrow £30,000 for electric lighting purposes. There was no opposition.

The Stockton Corporation last Tuesday ordered an application to the Public Works Loan Commissioners for a loan of £28,482 for the purposes of electric lighting, at 2¾ per cent. interest, with the repayment extending over 25 years.

Wigan will soon be in possession of an electric lighting undertaking. The Town Council having made up their minds on the subject, it is, according to Alderman Holmes, the intention of the Electric Lighting Committee to proceed with the installation as speedily as possible.

For the purpose of increasing the generating power at their central electricity station and providing new cables, the Birkenhead Corporation are seeking the sanction of the Local Government Board to the borrowing of an additional £15,000. An inquiry into the proposed expenditure was held last Thursday by Major-General Crozier; and there was no opposition.

The report comes from Cardiff that some of the Borough Magistrates and the Coroner had experience last Tuesday evening of the vagaries of the electric light. While a Police Court was sitting at the Town Hall, and the Coroner was holding an inquiry in another part of the building, the light suddenly failed, and business had to be suspended till the fitful current returned and once more dispelled the darkness.

At the meeting of the Aberystwyth Town Council last Tuesday, Mr. R. Peake presented the report of the Public Lights Committee, which recommended the Council to enter into an agreement for two years with the Electric Light Company to supply electric energy for the lamps of the town at a yearly sum of £17 17s.; and that a penalty of 1d. per minute be enforced in the case of failure of the light. The report was adopted.

The Canterbury Town Council last Wednesday resolved to apply to the Local Government Board for a loan of £12,000 to cover the increased expenditure already incurred in connection with their electric lighting works and proposed extensions of the plant. Regarding this additional loan, the "Kent Herald" is not in the least surprised that it is required, as from the outset our contemporary has maintained that the scheme could not be carried out for the sum originally applied for.

According to the report of the Electrical Engineer, the demand for electricity in Exeter is increasing in a compound ratio, while the delay in

obtaining machinery and other requisites makes it difficult to keep pace with it. Instructions have accordingly been given to the City Surveyor and the Engineer to consider and report upon the different methods by which the capacity of the works can be increased. As there is a proposal to establish a municipal system of electric tramways in the city, the ultimate extension of the electricity works promises to be considerable. A company had been in negotiation with the Corporation, with the object of securing consent to their purchase of the existing horse tramways, and the fitting of them for electric traction. The Corporation came to the conclusion, however, that they ought to do this work themselves; and they will oppose the application of the company for a Provisional Order, and endeavour to acquire the tramways at the earliest possible date.

A memorial, signed by upwards of 5000 ratepayers and others, has been addressed to the Lord Mayor and Corporation of the City of London in support of the application made to the Board of Trade for a Provisional Order enabling the Charing Cross and Strand Electricity Supply Corporation, Limited, to supply electric energy within the City of London. The grounds for the memorial are set forth as follows: (1) That monopoly of supply by any one company is adverse to the interests of the ratepayers and the public. (2) That the rate charged for the supply of electric energy by the Corporation is very considerably less than that charged within the City by the present Supply Company. (3) That the service of the Corporation is a more economical, steady, and efficient service. (4) That the low-tension distributing system is a safer one for many reasons, among others the avoidance of fireproof transformer rooms or apparatus on the premises supplied with energy. (5) That the low-tension direct-current system appears, *inter alia*, to be the best adapted for arc lighting and motive power purposes. The memorial is signed on behalf of 29 banks, 81 insurance companies, and 82 newspaper offices.

A statement was laid before the Torquay Town Council last Tuesday of the cost of the electric light undertaking. The Corporation borrowed the sum of £22,300; but the expenditure was £24,867. Of this sum, however, £920 was spent in anticipation of future extensions, so that the actual cost of the existing works was £23,946, or £1646 in excess of the money borrowed. In explanation of the excessive expenditure, Mr. W. H. Trentham, the Consulting Engineer, wrote that the expenditure on mains would have been only £5000, or £381 less than the estimate; but as the work proceeded, the Committee authorized extensions which cost £589. Instead of 70 arc lamps, 52 were fitted; and this item was reduced by £437. The cost of the machinery at the station was increased by £840, mainly because of the change in the site; and this also increased the cost of building alterations from £750 to £1865. By this change, however, the capacity of the works can be increased by two-thirds without further expenditure upon buildings. Mr. Trentham pointed out, in conclusion, that the cost per kilowatt is only £53—"a much lower figure than in any other public works in the kingdom, in some of which the capital outlay has been very extravagant." The Council decided to defer the discussion of the report until March; it being thought unfair to the Electric Lighting Committee to review the matter now. One of the members intimated, however, that this decision would not prevent him putting a series of questions on the subject when the Council next met.

According to the "Financial News," there has been a remarkable growth in the electric lighting industry in Germany. From certain statistics just to hand, Germany boasts of 23 industrial or financial companies in connection with electricity, the capital of each of which amounts to at least 1,500,000 marks. The most important possesses a capital of 47,000,000 marks, while that of six others varies between 24,000,000 and 40,000,000 marks, five others range between 10,000,000 and 16,000,000, and eight control from 3,000,000 to 8,000,000 marks. Among the last mentioned, the Union of Berlin have just decided upon the increase of their capital from 3,000,000 to 18,000,000 marks. The share capital of these 23 concerns is 354,000,000 marks, out of which a sum of 317,000,000 marks has been paid up. But, with the debenture capital amounting to 102,160,000 marks, and the reserve funds of 36,564,714 marks, it can be stated that a total amount of 493,000,000 marks is invested in the great German electrical enterprises, not taking into consideration the numerous minor companies. The last dividend declared by 20 of these ventures has varied between 5 per cent. (minimum) and 15 per cent. (maximum); the average being 9 per cent. The following figures show the development of this branch of industry in Germany within recent years: Of the 23 great companies already mentioned, four were promoted from 1883 to 1890, seven from 1892 to 1894, four in 1895 and 1896, seven in 1897, and this year one with a capital of 1,600,000 marks. Such a rapid development naturally created great competition, which has brought about speculation to so serious an extent that German economists fear a crisis, and a subsequent reaction upon the economic life of the country.

At last Wednesday's meeting of the Leeds City Council, what is all but the final step was taken for the acquisition of the local electric supply on behalf of the inhabitants. The Parliamentary Committee recommended that, under the authority of the Leeds Order (No. 2) 1898, the Corporation create Leeds Corporation Irredeemable Stock to the amount of £217,420, bearing dividends at the rate of 5 per cent. per annum—such stock being sufficient to produce by the dividends thereon the annuity referred to in section 59 of the Leeds Order, 1891, and to be issued or transferred to the Yorkshire House-to-House Electricity Company in satisfaction of the said annuity. On this being done, it was anticipated that the undertaking could be transferred as from Thursday next, the 15th inst. The Company's expenditure on capital account up to December last was £157,000; and since that time £60,000 odd had been spent on the same account. The Corporation were compelled under their Act of Parliament to pay the Company all their capital expenditure, less such sum as the Government Auditor might set aside for depreciation, which would amount to several thousand pounds. This was a bargain made by the Corporation some years ago, and the present Council could not help carrying it out. The recommendation was adopted, as was also a motion authorizing the Parliamentary Committee to raise and pay all additional moneys which might be or become payable by the Corporation to the Company in connection with the agreement (dated the 8th ult.) between the Company and the Corporation for the purchase by the Corporation of the Company's undertaking, and in all other respects to carry out and complete the terms of the agreement with such modifications (if any) as they might deem expedient.

In direct opposition to the advice of the Lighting Committee, to whose consideration the matter had been referred, the Penzance Corporation decided yesterday week to oppose the application of Edmundson's Electricity Corporation for a Provisional Order, and undertake the business of providing electric light themselves. The Committee appear to have been afraid that other and more urgent schemes, including the provision of a better water supply, would render it impossible for the Corporation to embark in the immediate future upon so large an enterprise as that of erecting electric light works. They were also of opinion that the clauses which the Company offered to insert in the Order, if they were unopposed, were exceptionally fair, and that at any rate, the Company might well be left to bear the risk of the first seven years. The majority of the Council, however, took the line that the Corporation ought to do the work themselves. It was suggested that a refuse destructor might be combined with a scheme of electric lighting, and a saving of £200 effected in the cost of disposing of the refuse. Another reason for the Corporation undertaking the supply of electricity was that the amount paid for public lighting would go to the credit of the Corporation, and give them at the same time a means of opposing the monopoly of the Gas Company, who were said to be charging an excessive price. One of the members thought the Corporation ought to purchase the gas-works as well as establish the electric light. It seems, however, to have been considered sufficient to undertake one of these things at present. The recommendation of the Lighting Committee that the application of Edmundson's Company for a Provisional Order should be assented to was rejected by 12 votes to 3. The Town Clerk said the Company had informed him that if the Corporation did not assent they should still deposit the Order, and fight it to the bitter end.

There was an abnormally large attendance of members at the fortnightly meeting of the Winchester Board of Guardians on the 3rd inst., when an important resolution concerning the use of gas or electricity in the workhouse was brought forward. A month ago, the Board decided, by the narrow majority of two, to introduce electric light. At the subsequent meeting, however, one of the country members (Mr. Shepherd) stated that he had only received his *agenda* a few hours before the meeting, and was unable to put off another engagement in order to attend and oppose the adoption of electricity. He therefore gave notice that he would, at the next meeting, move that the resolution passed at the meeting on the 5th of November should be rescinded. Considerable indignation was accordingly felt by the members of the Visiting Committee, who had made elaborate arrangements for the adoption of electricity, and who, it was thought by some, had exceeded their duty by inviting tenders for the work before their recommendation had been adopted. A good deal of feeling was displayed on both sides; and the discussion which took place at the meeting on the 3rd inst. was of the liveliest character. Mr. Shepherd, in moving his resolution, commented upon the manner in which the whole thing had been worked. He then alluded to the reduction the Board had effected in their gas bill the previous year by the adoption of incandescent burners; and said the inmates of the house, especially the sick and infirm, would never get used to so cold and miserable a light as that afforded by electricity. Mr. Simpkins, in seconding the motion, remarked that 9d. per unit for electricity, which the Board had decided to pay, was far too expensive. Last year, through the adoption of incandescent burners, they had saved considerably; and their last annual gas bill only amounted to £56. He had been told on good authority that the electric light would cost at least £100 a year; and, in addition to this, they would have to expend between £20 and £30 annually for the supply of gas to the engine and for disinfecting purposes. Mr. Easther pointed out that electricity had a tendency to make the atmosphere stagnant, while warmth from gas-burners caused a circulation of the air, and thereby promoted ventilation. He considered electricity was an experiment; and what right had they, he asked, to risk public money in an experiment before it had been found successful. Mr. Marks championed the cause of electricity, and offered to lend the Board £166 (the initial cost of the installation) if they would agree to give him half the savings effected in cleaning and decorating during the next ten years. Other members having spoken, the Chairman closed the discussion with a few remarks in favour of the adoption of electricity. On being put to the meeting, the motion was carried by 22 votes to 18; five members not voting.

METROPOLITAN WATER SUPPLY COMMISSION.

Thirty-ninth Day—Monday, Dec. 5.

(*Viscount* Llandaff, *Chairman*, *Sir* John E. Dorington, Bart., M.P., *Sir* G. B. Bruce, M.Inst.C.E., *Major-Gen.* A. de Courcy Scott, R.E., *Rt. Hon.* J. W. Mellor, Q.C., M.P., *Mr.* A. de Bock Porter, C.B., *and Mr.* R. Lewis.)

The Commission sat at the Guildhall, Westminster.

The following are the Counsel engaged: Mr. Pope, Q.C., and Mr. Claude Baggallay, Q.C., for the New River and the Southwark and Vauxhall Companies; Mr. Littler, Q.C., and Mr. Lewis Coward for the Kent Water Company; Mr. Pember, Q.C., for the Lambeth, East London, Grand Junction, and West Middlesex Water Companies; Mr. Rickards for the Chelsea Water Company; Lord Robert Cecil for the Hertfordshire County Council; Sir Joseph Leese, Q.C., M.P., for the Kent County Council and Kent Local Authorities; Mr. Balfour Browne, Q.C., and Mr. Freeman, Q.C., for the London County Council; Sir R. Nicholson for the Middlesex County Council; and Mr. Gabriel P. Goldney (Remembrancer) for the Corporation of the City of London.

Mr. *R. Middleton*, cross-examined by Mr. Balfour Browne, said the places he had supplied with water were Honiton, Dauntsey, in Wilts, Rushton, and three county asylums near Hitchin; and at Huntingdon he had been engaged in altering the scheme. He had never constructed a large reservoir, nor such a masonry dam as was contemplated on the Upper Wye. Also he had never constructed a conduit, though he was now engaged on one. He had not had large experience in the transfer of water-works from companies to local authorities; having only once acted as arbitrator or umpire. Mr. Hunter and Mr. Fraser were responsible for the inception of the Staines scheme.

Mr. Balfour Browne: Was not the design of the Staines scheme as laid before Lord Balfour's Commission to take 300 million gallons a day

from the river, but to leave a minimum flow of 200 million gallons a day over Teddington Weir, if Nature would give it?

Witness: As regards leaving the 200 millions, yes. As to the 300 million gallons, they went up to that, but not over.

Is it not the fact that Lord Balfour's Commission did not commit themselves to the sufficiency of the 200 million gallons over Teddington Weir?—They did not say anything about it.

Were not all the floods exceeding 2300 million gallons to be rejected?—For sixteen days.

You have told the Commission that in your view any such rejection is not essential?—Yes.

So that you differ from the scheme as submitted to the Royal Commission?—I do. The total storage at Staines, according to Messrs. Hunter and Fraser, is to be 18,000 million gallons, in nine separate reservoirs; and a supply of 300 million gallons a day is contemplated.

In this scheme, was not the 300 million gallons a day to include the 130 million gallons which we roughly call the authorized draft of the London Companies?—That I am not clear about. I do not think there is anything specific on the subject in the report.

After further discussion, and a reference to the report of Messrs. Hunter and Fraser, witness said he thought it must have been included, if the minimum at Teddington was to be 200 million gallons. All the water dealt with in these reservoirs would be subjected to the processes of filtration and subsidence. Subsidence, however, was not necessary all the year round; and it would not take place when the water was delivered straight from the filter-beds.

Mr. Balfour Browne: Is it a fact that all your tables proceed upon the supposition that 35 gallons per head per day will be sufficient?

Witness: Yes.

Are you aware that in the Balfour Commission report the idea was that the average in 1931 would be only 29·73 gallons per head per day?—I do not think so. I have never understood it so.

If you look at paragraph 62 of the Commission's report, I think you will find it is so—the estimated daily supply per head in 1931?—Those are the Companies' estimates.

Mr. Balfour Browne: I am going to show that the Companies were wrong. This is what the Commission took from the Companies, as what would be required in 1931.

Mr. Pope: The Commission gave 35 gallons per head.

Mr. Balfour Browne: Now I want to show that the Commission and Mr. Middleton, in taking 35 gallons, are adopting too small a figure. The Companies at that date took a much smaller figure even than you take now—viz., 29·73 gallons. Are you aware that since the report was published in 1893, the Chelsea Company have increased their consumption by 9·6 gallons per head, the Kent Company by 1·51, the Lambeth Company by 3·18, the New River Company by 0·93, the Southwark and Vauxhall Company by 11·29, and the West Middlesex Company by 5·61?

Witness: It is quite possible; but I have not the figures before me.

Was not the average of the whole Metropolis in the year 1897 35·42 gallons per head actual consumption?—I daresay it was.

Sir G. Bruce: *Plus* waste.

Mr. Balfour Browne: *Plus* waste. But when we deal with the consumption per head, we always include the figure of waste.

Witness: We are obliged to.

Mr. Balfour Browne (to witness): What is the good of assuming that in 1931 the consumption will only be 35 gallons per head, when we find that in 1897 it was half a gallon more, and increasing, as I have shown you, in all these different Companies?

Witness: I think, as Lord Balfour's Commission said at the time, they erred on the side of liberality in using the figure of 35; and that estimate errs still on the side of liberality.

What is the good of liberality, when we find the actual consumption is more than what they called liberality?—I think it is more than it ought to be.

Is the tendency to increase the amount per head?—I think the tendency was to increase the amount per head as regards the use of water.

And if my figures are accurate (that the Chelsea Company have in six years increased their consumption by 9·6 gallons per head, and the Southwark Company by 11·29) this tendency is shown to be towards a very rapid increase indeed?—I do not think that is a necessary proof, because the years have been ones where the consumption of water would be likely to be high. Also it may be simply that there has been a very large amount of waste in a particular district.

Do you know anything of the waste in these two Companies?—Not as to that of the Chelsea Company. With regard to the Southwark and Vauxhall Company, I think it is matter of common knowledge that they had a very leaky main.

Do you not think it would be more safe to take as the actual consumption 40 gallons per head?—No, I think 35 gallons is ample.

Now as to the total quantities required. In 1891, according to Lord Balfour's Commission, there were 171,163,383 gallons supplied to London?—I will take that.

Then in 1897 the consumption was 202,102,554 gallons?—Yes. The 171 millions was a correction made by myself of the return of the Companies of 182 million gallons. The difference was allowance for slip and short stroke of the pumps.

That shows an increase in six years of close upon 31 million gallons?—Yes.

If the rate is maintained in 1931, the consumption would be 518 million gallons a day, as against 415 million gallons a day which was the calculation of the Balfour Commission?—That may be perfectly true. But while the arithmetic of the calculation is accurate, the figure is based on the difference between the first and the last of the six years. Very often there are jumps in a particular year. In the six years named, however, the constant supply has been more extensively introduced; and this would affect the quantity consumed very considerably.

The Southwark and Vauxhall Company stated before Lord Balfour's Commission that their average daily consumption in 1931 would be 30,386,425 gallons. Do you follow this?—I do.

Before Sir Joseph Pease's Committee, which sat in 1896, when the Company asked for further powers, they said that in 1931 the average daily consumption would be, not 30 million gallons, but 63,362,840 gallons. Do you remember that?—I do not remember the figures; but I daresay you are perfectly right.

Therefore in regard to this one Company alone Lord Balfour's Commission proceeded upon half the quantity of water which the Company five years afterwards said they would require?—I do not think Lord Balfour's Commission proceeded on any such basis. The Company stated the figure; but clearly Lord Balfour's Commission did not accept it.

Take the Lambeth Company. Did they say their requirements in 1931 would be 28,411,025 gallons?—Yes.

Their average daily supply in September last was 31,891,317 gallons, according to the Water Examiner's report?—Yes; but I must at once say that the supply of one month has nothing whatever to do with the question. I want the average figure for the year, not for one month.

The New River Company said before the Royal Commission that in 1931 they would require 47,250,000 gallons. Is it not a fact that before Sir Joseph Pease's Committee in 1896, they said that in the year 1915, or 16 years earlier, they would require 77,923,000 gallons?—That is so, I believe.

Therefore, so far as these Companies are concerned, they under-estimated at the time of the Royal Commission what they would require in 1931?—They over-estimated it on the latter occasion.

Mr. Balfour Browne: The over-estimate came five years later, when they were applying to Parliament for fresh powers.

Mr. Pember: That is what seems to me to throw suspicion on it.

In further cross-examination, witness agreed that a table put in by Sir A. Binnie showed that between 1867 and 1891 there was a total increase in the amount of water supplied of 73·59 per cent., but this introduced, among other things, the great frost. Taking the rate of increase at 2·32 per cent. per annum, and commencing with the year 1896, when the supply was at the rate of 198 million gallons a day, the requirements in 1931 might be 441 million gallons, as against 415 million gallons estimated by the Balfour Commission. But the year 1896 was not a fair one to take, because it included the great frost, when the consumption was far too large. He preferred the figures used by Lord Balfour's Commission. The Auditor in 1891 stated that the amount that had been expended by the Water Companies was £15,000,000 odd. Since 1891, there had been a further outlay of £6,320,000—or an increase of 41 per cent. Of the latter sum, £1,250,000 in respect of the Staines scheme, and £650,000 for the Southwark and Vauxhall Company, were to be used to bring the supply up from 130 to 185½ million gallons. No more water would be obtained by the expenditure of the other 4½ millions; but a good deal more would be delivered. The money was not to bring in more water; but to enable the Companies to deliver up to their capacity. The works were perfectly efficient; but they had to extend them to meet increasing demands. All the Companies, except the Kent, had been to Parliament in the last three sessions asking for further works and powers, on the ground of pressing necessity. Witness believed that the amount of 420 million gallons calculated as being available by the Balfour Commission could easily be increased.

Mr. Balfour Browne: Is it not a fact that the 52 million gallons (part of the 420 million gallons) which were to be derived from the Lea has broken down, as regards the East London Company, on four separate occasions since the report?

Witness: The 52½ million gallons were to be furnished with proper storage; but the storage has not been provided. When it is, the quantity will be available. The storage of the East London Company was in 1891 only 610 million gallons; and to-day it is 1210 million gallons. Yet the worst breakdown of the Company was the last.

Cross-examination continued: In 1897, they got power to provide a further 1015 million gallons storage, which would raise their storage capacity to 2225 million gallons. He could not say whether, with this storage capacity, supplying 32½ million gallons a day (their average for the past six years), and giving 5,400,000 gallons a day for the navigation of the Lea, their reservoirs would have been empty on July 3 last. If this would have been so, he should think the storage contemplated in 1897 would have been insufficient. Witness, however, believed that Sir A. Binnie a short time ago said the East London Company had plenty of storage. He (witness) agreed that if the figures given were correct, the Company had not sufficient storage in 1891, because they increased it. He was rather doubtful about the reservoirs being empty on July 3 last, because he thought Counsel had ignored the supply the Company derived from wells. The Company before the Balfour Commission said they could obtain 11 million gallons daily from wells; but in August last, when at their wits end for water, the total so obtained was 9,553,000 gallons. The water, however, was available though they had not the machinery to raise it. The New River Company also told Lord Balfour's Commission that they could obtain from their existing wells and springs 34 million gallons a day. The greatest quantity obtained was 26,977,000 gallons in September last. Here also the water was available, though the machinery to take it out was not. Pumping from wells in the Lea Valley had a very limited effect upon the flow of the Lea. The water-level of London in the chalk was falling at the rate of 12 to 18 inches per annum. This was because more water was taken out than could get in, owing to the slipping of the clay over the chalk. The effect of this slipping was to some extent to retard the flow of the water in the chalk, and throw it out where the pressure occurred. If they relieved the slipping, by making underground channels or pumping, to some slight extent they could facilitate the water in getting out of the chalk. The ground east of the Lea basin and north of the Thames, as regarded well-sinking, might be ignored in any inquiry into the future water supply of London. He agreed that the rest-level of the Lea Bridge well was 10 feet, and of the Walthamstow well 15 feet, below Ordnance datum; but he doubted whether the rest-level at the South end of the Lea Valley was depressed by exhaustive pumping under London. If the figures given indicated the true rest-level, the chalk water in the lower part of the Lea Valley could not, as he had contended, be flowing into the Thames or into the sea; but the rest-level of a well was not always the rest-level in the stratum. Witness was certain it was impossible for a well to deplete above the limit of its cone of exhaustion, which limit might extend a little beyond a mile. As wells extended in the Lea Valley for about ten miles, within this ten miles, and a mile on either side, the Companies might be drying Hertfordshire. The Kent Company had only been pumping as a maximum 18,686,384 gallons out of 27½ millions they said they could get; but he was not aware that Kentish streams as a consequence were being dried. He believed that a large further quantity of water could be obtained from East Kent. He based this belief on a statement

in the Balfour report. He was not aware of the results since 1893 of gaugings of springs and observation of 400 wells there.

The CHAIRMAN, addressing Mr. Balfour Browne, said the cross-examination seemed to tend to show that the supplies of water enumerated by Lord Balfour's Commission were not reliable; that the needs of the Companies were more than they had estimated; and that consequently the urgency of going to Wales was demonstrated.

Mr. BALFOUR BROWNE assented.

The CHAIRMAN went on to ask him to remember that the present Commission had nothing at all to do with deciding the question whether the water in the Thames or Lea would be sufficient for the future wants of London or not. If Counsel satisfied the Commission that they must go to Wales, possibly that would be an argument against the Commission's sole subject of inquiry—viz., the financial expediency of purchase—because that might lead to larger expenditure on the part of the purchaser.

Mr. BALFOUR BROWNE thought if he could show what the cost of the Staines scheme would be on completion, it would bear on the question.

The CHAIRMAN: That is quite open to you.

Mr. BALFOUR BROWNE said Mr. Middleton had gone beyond the Balfour Commission report, and said he could go on beyond 1931; whereas he (Counsel) held that they must anticipate this time—that the money at present expended would not meet the wants until 1931, and that anybody in charge of the water supply, whether the County Council or the Companies, or anybody else, would have a large expenditure to meet soon.

The CHAIRMAN remarked that this would not diminish the cost of purchasing the Companies as they stood; it would only add to the future expense.

Mr. BALFOUR BROWNE said then it would come to this: Whether it was not financially expedient to pass these concerns into the hands of the body who could do the work most cheaply.

Cross-examination continued: He did not think the existing or future population of the Thames Valley would have any injurious effect on the river, even though it might number 1,463,000 persons in 1931, and the sewage discharge be 29¼ million gallons daily, or 7½ per cent. of the dry weather flow. If 400 million gallons daily were taken from the Thames in a year like 1893, the flow would be reduced to 200 million gallons or less on rather more than 200 days; in a year like 1898, on 137 days, or perhaps a few more. There had been only ten days in any year when the natural flow of the river was below 200 million gallons.

It had been as low as 43 million gallons, and there were no complaints. In 1893, the period of the drought was greater than in 1898; but in the latter year it was more intense. The flow of 200 million gallons over Teddington Weir would have little scouring effect. The existence of the upper part of a tidal river depended on the flood-water, if not on the fresh water flowing down. Without fresh water, there would be no downward action. Filter-beds required cleaning at frequent intervals—how often depended on the state of the river. He believed they were cleaned usually at periods of from 14 to 28 days. On the average, there were two grains per gallon (70,000 parts) of matter suspended in river water. Possibly there might be from 2·1 to 2·6 parts per 100,000 parts in Loch Katrine water; but there was a large amount of peaty matter in this water. At the maximum, the matter would be three or four times as much. Witness had known reservoirs that had been for 19, 18, 12, and 23 years without cleaning. He calculated the net storage to supply 300 million gallons daily at 29,602 million gallons, as compared with Messrs. Hunter and Fraser's figure of 18,000 million gallons; the difference being due to the droughts of 1893 and 1898, of which Messrs. Hunter and Fraser had had no experience. Notwithstanding this enormous difference, his estimate for the total quantity was £8,618,000; while Messrs. Hunter and Fraser's was £9,702,000. A number of cases were then put to witness in which he had estimated the cost per million gallons of water under the Staines scheme at a certain figure, and then for extra quantities under the same scheme calculated the cost at a much lower figure per million gallons. He explained that the difference was due to the fact that the first estimate included works which would benefit subsequent supplies. Asked how it was that Messrs. Hunter and Fraser, for only 18,000 million gallons of storage, with necessary pumping power, allowed £5,391,000, while he, for 29,602 million gallons of storage, allowed £5,778,000, witness said with the original reservoirs as designed by Messrs. Hunter and Fraser it was proposed to excavate to a distance of from 10 to 11 feet, to take so much of the excavated earth as was required to make the banks, and to run the remainder to spoil. With the present reservoirs, the excavation would be limited to that which was required to make the banks, and thus a great deal would be saved. The Staines reservoirs, as being constructed, would supply under the conditions of 1893 a much larger quantity than the limit of 35 million gallons imposed by the Act of 1896.

The Commission adjourned.

The fortieth sitting of the Commission was held yesterday at the Guildhall, Westminster—Lord Llandaff presiding—when Mr. Reginald E. Middleton attended for further cross-examination by Mr. Balfour Browne, on behalf of the London County Council, with regard to his estimates concerning the Staines and Welsh schemes.

THE VIEWS OF THE METROPOLITAN VESTRIES AND DISTRICT BOARDS ON THE FUTURE CONTROL OF THE WATER SUPPLY.

In the "JOURNAL" for the 29th ult., we gave the result of an inquiry instituted by the Battersea Vestry with the object of ascertaining the views of the various Vestries and District Boards as to the future control of the London water undertakings. As already mentioned, the preponderating opinion is in favour of a Water Trust or other central authority; and it was ascertained in reply to the following questions: (1) Are you in favour of the water supply being vested in a public authority; (2) if so, in what authority, and how should it be constituted; and (3) are you prepared to assist in the promotion of a Bill in Parliament dealing with the question. Taking the answers of the Vestries in alphabetical order, the Battersea Vestry think the supply should be vested in the London County Council. The Bermondsey Vestry consider that it should be managed by a Water Trust elected from the City Corporation, the London County Council, the Thames Conservancy, the Vestries and District Boards, and all the governing bodies in Greater London whose districts are supplied by the Water Companies. The Camberwell Vestry think the supply should be under the control of a body representing the ratepayers, and not in the hands of private Companies; such body to be directly elected by the ratepayers. The Clerkenwell Vestry are of opinion that the supply should be placed in the hands of an authority under the Government; while the Fulham Vestry think it should be in the hands of "the central authority," and the Hackney Vestry in the possession of the London County Council. The Hammersmith Vestry consider that a central authority should be created, to be elected from members of the City Corporation, the London County Council, and the Sanitary Authorities of the Metropolis; and the Hampstead Vestry think the water supply should be vested in a public central authority. The Islington Vestry favour the London County Council. The Kensington Vestry think no action should be taken in regard to the question, in view of the proceedings of the Royal Commission. The Vestry have previously dissented from the purchase of the undertakings by the County Council; rather favouring legislation which would secure to the water consumer some more effective control without purchase. The Lambeth Vestry consider the supply should be placed in the hands of a local authority chosen by parochial electors for the whole of the area supplied. The Newington Vestry, like Islington, favour the London County Council as the possessors of the supply. The Plumstead Vestry declined to express any opinion pending the report of the Royal Commission. The Rotherhithe Vestry consider that a Water Trust should be created by the Government, upon which the Metropolitan Sanitary Authorities would be represented. The Vestry of St. George's, Hanover Square, are of opinion that Parliament should empower the London County Council or some central authority to provide water for the people; while the Vestries of St. George's, Southwark, and St. Luke's, Middlesex, consider that the supply should be vested in the London County Council. The St. Martin's-in-the-Fields Vestry think the supply should be in the hands of a public authority; but they regard the matter as not ripe for the consideration of details. The Vestry of St. Marylebone hold the view that there should be a central authority, but that it should not be the London County Council. St. Pancras and Shoreditch, on the other hand, think the Council should own the supply. The Vestry of Stoke Newington are of opinion that the supply should be in the hands of an authority composed of representatives comprised within the area served. The Vestry of St. James's, Westminster, hold the view that the London County Council should be placed in the position of trustees, with obligations to ratepayers and consumers alike.

The questions were put to nine Boards of Works in the Metropolis. The Holborn Board consider that the water supply should be vested in an authority specially constituted for the purpose, such as a Water Board or Trust. The Lee Board think the water undertakings should be managed and controlled in conjunction with the Companies by representatives of the London County Council, the City Corporation, the Councils of all other counties and the Vestries and District Boards within the limits of supply. The Limehouse Board favour the formation of a Water Trust, consisting of members directly elected by the people in the areas affected; whereas the neighbouring Board of Poplar consider the supply should be vested in the County Council. The St. Giles Board are not in favour of the supply being in the hands of a public authority. The St. Olave's Board think an authority, consisting of the London County Council and representatives of local bodies outside the county, should own the water supply; while the St. Saviour's Board are of opinion that the control of the supply should be vested in a corporation composed of representatives elected by the several County Councils. The Strand District Board thought the control should be placed in the hands of a central authority; but the Board are not prepared to express any further opinion pending the report of the Royal Commission. The Whitechapel Board consider that a competitive supply should be provided, or the whole supply taken over by a body directly representative of the ratepayers.

With regard to the question of promoting a Bill to deal with the water question, the majority of the authorities who have replied state that they have no legal power to render any financial assistance in the matter.

The Stockton and Middlesbrough Water Scheme.—It is understood that at a private meeting of the General Purposes Committee of the Middlesbrough Corporation last Thursday, it was resolved to recommend the Council to authorize the Stockton and Middlesbrough Water Board to proceed with their Bill in Parliament for additional powers, provided they can get an increased charge for water supplied to the large consumers. From a recent return of the accounts of the Board, it is to be seen that the average price per 1000 gallons realized from the large consumers last year was 3·7066d., and from domestic consumers 8·3112d.; the average being 4·7673d. The cost for working expenses, &c., is 1·0546d. per 1000 gallons; but interest and redemption last year amounted to 4·7641d. per 1000 gallons—practically equal to the average revenue. Thus there is a loss of 1·0514d. per 1000 gallons; and it is to avoid this demand upon the rates of the constituent authorities that the Middlesbrough Council wish the Board to secure an increased income from the large consumers.

The Wages Question at the Darlington Gas-Works.—The Sub-Committee appointed at a recent meeting of the Darlington Town Council to investigate the matter of the application of the men at the gas-works for an increase of wages, met a deputation from the latter last Wednesday. The deputation, which consisted of ten or eleven men, was headed by Mr. Lynas, the District Secretary of the Gas Workers' Union, who acted as spokesman. Besides the members of the Sub-Committee, there were present the Town Clerk (Mr. H. G. Steavenson), the Engineer (Mr. T. Smith), and the Manager of the works (Mr. F. P. Tarrat). Mr. Lynas placed the case for the men before the Sub-Committee, quoting the rates of wages paid at Sunderland, Newcastle, and South Shields. The request in effect is for an advance of wages of 2s. per week all round; the men involved being the stokers, the cokemen, the fire cleaners, the coal wheelers, the boilermen, the labourers, &c., numbering over 100. It was intimated to the deputation that the Sub-Committee would look into the application and give an answer in due course. The interview lasted above an hour.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Corporation of Glasgow on Thursday adjusted the clauses of their Gas and other Bills for the next session of Parliament. So far, there does not appear to be any opposition to any of the measures. On the Gas Bill, the first 32 clauses were adopted without comment, which says a great deal for the skill of the draftsman in interpreting the wishes of the Corporation. In some smaller corporations, I fancy, the passing of so many clauses without discussion or explanation would have been looked upon as little short of a scandal. In Glasgow, however, the multitude of subjects before any one meeting of the Corporation, precludes the notion of each member speaking his mind upon every question, for the benefit of the ratepayers—or for his own glorification—as seems to be the practice in some municipalities. The clauses following the 32nd deal with electricity; and one or two remarks were made regarding supplies beyond the city boundaries. Bailie W. F. Anderson suggested that there should be a differential rate on outside users of electricity. He thought it strange that the community of Glasgow should take all the risk of such undertakings, and that outsiders should participate in the advantages. Mr. A. Murray asked whether they would be obliged to supply gas or electricity beyond the city boundaries. Replying to these questions, Sir James Marwick, the Town Clerk, said that Parliament had already laid down the principle that if they supplied gas (and electricity would be in the same position), there must be no differential rate. They were not obliged to supply beyond the boundaries of the city.

On Tuesday, the Dundee Town Council adjusted the clauses of their Bill, in which, among other provisions, power is taken to enlarge the gas-works. As drafted, the Bill proposed that the cost of the promotion of it should be borne by the Town Council. The Corporation, however, considered that, as the Gas Commissioners had so large an interest in the Bill, in the way of having the new ground required for extensions legalized, they should bear a reasonable share of the cost. The clause was accordingly altered so as to make the Gas Commissioners bear one-third of the expense of the Bill. This is quite reasonable.

The vacancy in the gas managership of Falkirk was advertised, according to the resolution of the Committee, in the "Scotsman" and "Glasgow Herald" newspapers. Assuredly it was not the prodigality of the Commissioners in the making of their want known to the class whom they wished to reach which led to a large number of replies being received. Questions of personal friendship—perhaps of personal interest—must have led to the circulation, far and wide, of the fact that a manager was wanted for the Falkirk Gas-Works. The time given was short. It was only on Nov. 23 that the Committee instructed the advertisements to be issued; and replies were required to be in by the 2nd inst. This gives nine days, including Sunday—not a very long time in which to send out intimations, and for applicants to get together testimonials and have them printed and forwarded. Expedition in matters of this sort is good for all concerned; but this is, to my mind, going a little too fast, and may lead to the giving of some credence, which would not otherwise have been the case, to the statement that the man had been already selected. The salary offered is not less than £230, to include everything; the Committee having resolved to discontinue the practice of giving an allowance for house and gas. It is not a princely sum for a rising place like Falkirk; but it has brought forward, according to Bailie Cook Rennie, applications from gentlemen in almost every town in Scotland, and from some places in Ireland. The applications, he said, were so numerous, and the testimonials so voluminous, that the Committee, who had hoped to bring forward a list of candidates whom they considered eligible on Monday last (the 5th inst.), had been unable to do so. They had adopted the method of sending the applications and testimonials round the members of the Committee, so that everyone should be examined carefully, and there should be no respect of persons—every man being judged according to his merits. The only difficulty the Committee had now, Bailie Rennie said, was in fixing, among so many good men, who was the best. This took place at a meeting of the Town Council on Monday. On Thursday, the Committee met and drew up a short leet of candidates. Three names were agreed upon; Mr. J. Kincaid, of Peterhead; Mr. J. M'Nair, of Wishaw; and Mr. T. Lighbody, of Renfrew.

The subject of the lighting of Cowdenbeath was before the Police Commission of the burgh on Thursday night. The Committee in charge of the matter reported that they had had three schemes before them, and that they had agreed to ask a Glasgow firm the terms upon which they would be prepared to fit up an electric installation. The firm replied; and the Committee were of opinion that the estimated cost was too great to justify them in recommending such a scheme to the Commissioners. At the request of the Committee, the whole subject was recommitted to them. The Clerk reported that the Gas Company were now supplying oil gas, and were likely to do so for some weeks at least.

At certain times there is an outbreak of abuse of railway companies for not supplying a sufficient number of waggons for the conducting of the coal traffic of the country. Whenever this symptom appears, one may be certain that prices for coal are disposed to rise. It is better that the reason why waggons are sometimes scarce should be known. There may be, and probably there are, more causes than one; but the principal reason is to be found in the practice which exists of large coalowners having waggons of their own. The railway companies rely upon having the service of these waggons; and they do have the use of them in ordinary times. But there come periods when an advance in prices is looked for; and traders' waggons are loaded up and run into sidings, ready to be rushed into the market when the desired price is obtained. The railway companies are then called upon to furnish waggons to take up the running in place of those standing idle; and they are unable to do so. One of these crises is on just now. Doubtless gas managers will be suffering inconvenience in the delivery of coal. It is right, therefore, that they should be able, in the matter of liability for non-delivery, to put the saddle on the right horse. It may also be of service to them to know that, when such outcries arise, coal is about to be dearer.

A report by Professor Frankland, of Birmingham, upon the water supply of Paisley, which had been sought on account of a recent outbreak of typhoid fever, has been submitted to the Local Authority. In a summary

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1347.

Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	21—22	+½	4 15 5
100,000	10	"	7½	Do. 7 p. c.	16—17	..	4 8 3
300,000	100	July 1	5	Australian 5 p. c. Db.	105—107	..	4 13 6
200,000	5	Nov. 11	6	Bombay, Ltd.	6¼—6¾	..	4 2 11
40,000	5	"	6	Do. New, £4 paid	4¼—4¾	..	5 1 1
380,000	Stk.	Aug. 12	12	Brentford Consolidated	275—280	..	4 5 9
240,000	"	"	9	Do. New	210—215	..	4 3 9
60,000	"	"	5	Do. 5 p. c. Prf.	140—145	..	3 9 0
159,375	"	June 10	4	Do. 4 p. c. Db. Stk.	130—135	..	2 19 3
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	263—268	..	4 5 10
226,320	"	"	8½	Do. A. Ord. Stk.	190—195	..	4 7 2
933,500	Stk.	Aug. 31	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	48½—49½	−½	4 0 10
50,000	10	Aug. 12	11½	Bromley, Ord. 10 p. c.	25—27	..	4 5 2
75,000	10	"	8½	Do. 7 p. c.	20—22	..	3 17 3
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd	9½—10	..	6 0 0
98,122	Stk.	June 29	4	Do. 4 p. c. Db. Stk.	98—100	..	4 0 0
150,000	20	July 14	8½	Cagliari, Ltd.	29—30	..	5 10 0
100,000	10	Sept. 29	7	Cape Town & Dis., Ltd.	14—15	..	4 13 4
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	57—59	..	5 1 8
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	310—315	..	4 5 9
200,750	"	"	10½	Do. New do.	240—245	..	4 5 9
200,750	"	June 10	4½	Do. 4½ p. c. Db. do.	147—152	..	2 19 3
800,000	Stk.	June 10	10†	Continental Union, Ltd.	205—210	..	4 15 3
200,000	"	"	7†	Do. 7 p. c. Prf.	190—195	..	3 11 10
51,600	Stk	Aug. 31	14	Croydon A 10 p. c.	305—310	..	4 10 4
168,400	"	"	11	Do. B 7 p. c.	255—265	..	4 3 0
555,000	Stk.	Aug. 12	5½	Crystal Palace Ord. 5 p. c.	125—130	..	4 0 9
60,000	"	"	5	Do. 5 p. c. Prf.	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd.	23—24	..	4 11 8
354,060	10	"	11	Do. £7 10s. paid	17—18	..	4 11 9
5,922,230	Stk.	Aug. 12	12½	Gaslight & Coke, A, Ord	285—290	+2	4 4 6
100,000	"	"	4	Do. B, 4 p. c. max.	120—125	..	3 4 0
665,000	"	"	10	Do. C, D, E, 10 p. c. Prf.	308—313	..	3 3 11
30,000	"	"	5	Do. F, 5 p. c. Prf.	152—157	..	3 3 8
60,000	"	"	7½	Do. G, 7½ p. c. do.	233—238	..	3 3 0
1,300,000	"	"	7	Do. H, 7 p. c. max.	195—200	..	3 10 0
463,000	"	"	10	Do. J, 10 p. c. Prf.	308—313	..	3 3 11
476,000	"	"	6	Do. K, 6 p. c. Prf.	185—190	..	3 3 2
1,061,150	"	June 10	4	Do. 4 p. c. Db. Stk.	131—133	..	3 0 2
294,850	"	"	4½	Do. 4½ p. c. do.	148—153	..	2 18 10
958,000	"	"	6	Do. 6 p. c. do.	195—200	..	3 0 0
70,000	10	Nov. 11	8	Hongkong & China, Ltd.	13¾—14½	..	5 10 4
3,800,000	Stk.	"	10	Imperial Continental	223—226	..	4 8 6
376,400	100	Aug. 2	4	Do. 4 p. c. Dbs. Red.	98—101	..	3 19 3
473,600	Stk.	Aug. 12	3½	Do. 3½ p. c. Db. Stk.	102—105	..	3 6 8
560,000	100	Oct. 1	5	Met. of Melbourne } 5 p. c. Db.	110—112	..	4 9 3
250,000	100	"	4½	} 4½ p. c. Db.	105—107	..	4 4 1

Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	Nov. 30	6	Malta & Medn., Ltd.	4¾—5¼*	..	5 14 3
541,920	20	Nov. 11	5	Monte Video, Ltd.	13—14	..	7 2 10
617,946	Stk.	Aug. 31	9¾	Newc'tle & Gateshd Con.	232—234	..	4 2 8
252,355	Stk.	Jan. 3	3½	Do. 3½ p. c. Db. Stk.	113—117	..	2 19 10
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7¼*	..	5 6 8
135,000	5	"	8	Do. New, £4 10s. pd.	6¼—6⅝*	..	5 6 8
15,000	5	"	8	Do. do. 1879, £1 pd.	1¼—1½*	..	4 11 5
60,000	5	Sept. 29	7	Ottoman, Ltd.	5—5½	..	6 6 2
500,000	100	Dec. 1	6	People's Gas } 2nd M. of Chicago } Bd.	102—105*		5 13 2
848,070	10	Oct. 13	6	River Plate Ord.	9—9½	..	6 6 4
250,000	Stk.	June 29	4	Do. 4 p. c. Db. Stk.	99—101	−¼	3 19 3
250,000	10	Sept. 29	10	San Paulo, Ltd.	15—16	..	6 5 0
135,000	Stk.	Sept. 15	10	Sheffield A.	242—245	..	4 1 8
309,053	"	"	10	Do. B.	242—245	..	4 1 8
447,427	"	"	10	Do. C.	242—245	..	4 1 8
5,600,000	Stk.	Aug. 12	5½	South Metrop., 4 p. c. Ord.	137—140	−1⅓	3 16 1
1,460,000	"	July 14	3	Do. 3 p. c. Db. Stk.	102—105	..	2 17 2
60,000	Stk.	Aug. 31	12	Tottenham and } A.	280—290	..	4 2 9
60,000	"	"	9	Edmonton } B.	200—210	..	4 5 9
182,380	10	June 10	7	Tuscan, Ltd.	10—11	−⅓	6 7 3
149,900	10	July 1	5	Do. 5 p. c. Dbs. Red.	100—103	..	4 17 1
				WATER COMPANIES.			
746,164	Stk.	June 29	10½	Chelsea, Ord.	313—318	..	3 6 0
150,000	"	"	5	Do. 5 p. c. Prf.	170—175	..	2 17 2
160,000	"	"	4½	Do. 4½ p. c. Pf. Stk., 1875	148—152	..	2 19 3
175,785	"	Sept. 29	4½	Do. 4½ p. c. Db. Stk.	157—162	+2	2 15 7
1,720,560	Stk.	Oct. 13	7	East London, Ord.	212—217	..	3 4 6
654,740	"	June 29	4½	Do. 4½ p. c. Db. Stk.	158—162	..	2 15 7
390,000	"	"	3	Do. 3 p. c. Db. Stk.	103—105	..	2 17 2
700,000	50	June 29	7½	G'd Junct'n, 10 p. c. max.	115—118	..	3 3 7
310,000	Stk.	Sept. 29	4	Do. 4 p. c. Db. Stk.	138—143	..	2 15 11
708,000	Stk.	Aug. 12	14	Kent	365—370	..	3 15 8
160,000	"	"	7	Do. New, 7 p. c. max.	212—217	..	3 4 6
1,043,800	100	June 29	10½†	Lambeth, 10 p. c. max.	300—305	..	3 8 10
406,200	100	"	7½	Do. 7½ p. c. max.	230—235	..	3 3 10
350,000	Stk.	Sept. 29	4	Do. 4 p. c. Db. Stk.	138—143	..	2 15 11
500,000	100	Aug. 12	13½	New River, New Shares	433—437	..	3 0 8
1,000,000	Stk.	July 28	4	Do. 4 p. c. Db. Stk.	138—143	..	2 15 11
902,300	Stk.	June 29	7½†	Southw'k & V'xhall, Ord.	177—183	+7	4 2 5
126,500	100	"	7½†	Do. do. 7½ p. c. max.	167—172	+5	4 7 3
489,200	Stk.	"	5	Do. do. 5 p. c. Prf.	170—173	..	2 17 10
1,019,585	"	Oct. 13	4	Do. 4 p. c. A Db. Stk.	138—143	..	2 15 11
1,155,066	Stk.	June 10	10	West Middlesex	295—300	..	3 6 8
200,000	"	"	4½	Do. 4½ p. c. Db. Stk.	162—165	..	2 14 7
200,000	"	Sept. 15	3	Do. 3 p. c. Db. Stk.	102—105	..	2 17 2

* Ex div.

† Next dividend will be at this rate.

of his investigations he states that, "while the results do not actually prove a connection between the water supply and the recent epidemic, they are obviously quite in harmony with the existence of such a connection; that, on general grounds, the water in the dead ends of mains is most calculated to cause mischief, because in the event of any dangerous contamination of a water supply having taken place, the morbific material (typhoid bacilli) will tend not only to accumulate in such areas of sluggish circulation, but they will also remain there for a longer period of time than in any other part of the network of mains. The water consumer in such an area will, therefore, not only be more likely to receive typhoid bacilli, but will receive them in larger numbers and over a longer period of time; and there is thus a greater probability of his infection being secured. These considerations show the high importance of the regular and frequent flushing of all such dead ends being carried out, and the serious danger to the water consumer of any want of attention to this duty." The Professor adds that the system which prevails in Paisley, of making a direct connection between the water-mains and the sewers, is one of the most serious breaches of the laws of hygiene which he has met with in the whole course of his experience, and which it is impossible to condemn in sufficiently strong terms. He has no hesitation in saying that it is the imperative duty of the sanitary authority to see that every single connection of this kind is forthwith abolished. As the result of Professor Frankland's investigation, Dr. Donald, the Medical Officer of Health for the burgh, feeling that his conclusions as to the cause of the epidemic have been established, and taking into account the opposition he received to his proposals for the improvement of the sanitary arrangements in the burgh, has tendered his resignation.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 10.

Sulphate of Ammonia.—There has been a quiet market all through the week; and prices have been barely maintained—the closing quotations being £9 18s. 9d. to £10 per ton f.o.b. at the ports. Consumers continue to buy in fair quantity for prompt and early delivery; but dealers have for the most part bought sparingly. In the forward position, makers' quotations remain at £10 5s. per ton, ordinary terms, f.o.b. Leith, and at £10, Beckton terms, London. But speculators are quoting abroad at about the equivalent of spot prices for near months; and a moderate amount of business has resulted.

Nitrate of Soda is a shade weaker in the forward position; but on spot quotations remain at 7s. 6d. per cwt. for good, up to 7s. 7½d. per cwt. for fine, quality.

LONDON, *Dec.* 10.

Tar Products.—There is no change of any moment in the position of the various articles constituting this market. Benzol continues its dull, uninteresting way. Pitch is moderately steady, although most producers are fully sold, and have no interest in the market operations in this article which dealers now and again import into it. Creosote continues firm; and the same may be said of heavy tar oils generally. Carbolic acid is in fair request, but shows no inclination to better prices, which it was hoped might come with the autumn of this year. The outlook, however, is undoubtedly healthy, and production is taken up. Anthracene is nominally quoted weaker; but the very best "A" makes are not being offered at anything like the price mentioned below. The naphthas are moving freely without any change in price. Tar is reported weaker; and distillers who have bought at high prices must be having a poor time.

To-day's values are: **Tar**, 14s. to 19s. 6d. **Pitch**, east coast, 24s. 6d.; west coast, 22s. **Benzols**, nominal, 90's and 50's, 8½d. **Toluol**, 1s. **Solvent naphtha**, 1s. 2d. **Heavy naphtha**, 1s. 2d. **Crude**, 30 per cent., naphtha, 3½d. **Creosote**, 3d. **Heavy oils**, 50s. **Carbolic acid**, 60's, 1s. 10½d. **Creosote salts**, 30s. **Anthracene**, nominal, "A," 3½d.; "B," 2½d.

Sulphate of Ammonia is only in indifferent request. Makers, however, are generally firm in their notions of value; and quantities for spot or early forward delivery cannot be obtained under £9 16s. 3d. to £10, according to port and conditions of delivery—in all cases less 3½ per cent. discount.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A strong healthy tone is maintained throughout the coal trade of this district, with a brisk inquiry for all descriptions of fuel. Many of the pits are working six days per week; while the general average is ten to eleven days per fortnight. The better qualities of round coal are now moving off freely for house-fire purposes; and, with low stocks at most of the collieries, the advent of a period of exceptionally severe weather would probably raise a difficulty in meeting requirements at not a few of the pits. List prices remain without quotable change, but are exceedingly firm at the maximum rates. Steam and forge coals are also in active demand for both inland requirements and shipment. Merchants and consumers in many cases are just now placing orders to cover themselves for next year, so as to provide against contingencies usually brought about by the holiday stoppages of the pits. Prices are decidedly hardening for good qualities of steam and forge coal, which, for inland sale, are fetching 7s. 9d. to 8s. 3d. per ton at the pit; and for shipment, 9s. and 9s. 6d. up to 10s. in special cases, for delivery at the ports on the Mersey or the Manchester Ship Canal. The advance in engine fuel reported last week has not in any way checked inquiry; and only in very isolated instances have customers raised objection to the higher rates. Supplies of the better descriptions of slack continue short to meet the requirements of merchants and consumers; and orders in excess of what collieries are able to entertain, still come forward at the advanced rates, with the result that here and there the tendency is towards still further hardening, where new business from outside quarters is offered. Ordinary qualities of slack could scarcely be bought under 4s. to 4s. 3d. per ton; good medium sorts, 4s. 6d. to 4s. 9d.; with best qualities quoted from 5s. up to 5s. 6d. for some special sorts.

Northern Coal Trade.—There has been since the last report continued

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28, BATH STREET.
Telegraphic Address: "GOTHIC."

BIRMINGHAM:
1, OOZELLS STREET.
Telegraphic Address: "GOTHIC."

MANCHESTER:
87, BLACKFRIARS STREET.
Telegraphic Address: "GOTHIC."

WINTER SEASON 1898-9.

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activity in the coal trade of this district. The quantities sent out have been extremely heavy; so that the stocks of consumers should have increased. There has been a good demand for best Northumbrian steam coals; and the price is now from 9s. 6d. to 9s. 10½d. per ton f.o.b. Second-class steam coals are 9s. per ton; and steam smalls are rather more abundant at 4s. 6d. In the gas coal trade, the deliveries for the last few days have been higher than for a very long period. There has been a large arrival of steamers; and with full work at the pits, as much as 24,000 tons daily have been sent out of one dock on the Tyne alone. For occasional cargoes, the prices quoted have varied from 8s. 9d. to 9s. 3d. per ton f.o.b.; while for contracts for export over next year 8s. is the quotation for good Durham gas coal. Prices of gas coke show little or no change this week.

Scotch Coal Trade.—There is continued activity in all branches of the coal trade; and indications seem to point to a further rise in prices. There is a large output of splint, and a good demand for it. Ell and main are also going off well, at slightly better prices. The quotations are: Main, 8s. 3d. to 8s. 6d. per ton f.o.b. Glasgow; ell, 9s. 3d. to 9s. 6d.; and splint, 9s. 9d. to 10s. The shipments for the week amounted to 153,514 tons—a decrease of 17,336 tons upon the preceding week, but an increase of 4664 tons over the corresponding week last year. For the year to date, the total shipments have been 9,206,968 tons—an increase upon the same period of last year of 1,583,615 tons.

The Proposed Additional Water-Works for Bury.—At a meeting of owners and ratepayers held at Bury last Friday, a resolution was unanimously passed sanctioning application by the Corporation to Parliament for power to construct a reservoir at Ogden and other additional water-works for the better supply of the borough and other districts within their water area.

The Proposed Acquisition of the Seaford Water-Works by the Local Authorities.—A meeting of owners and ratepayers of Seaford was held last Thursday, for the purpose of passing a resolution authorizing the Seaford District Council to join with Newhaven in promoting a Bill to Parliament empowering the Councils to purchase the undertaking of the Newhaven and Seaford Water Company. There were about 200 people present; and the resolution was carried practically unanimously.

Fatal Acetylene Gas Explosion.—Mr. Alfred Burlingham, aged 32, son of Mr. D. C. Burlingham, jeweller, of High Street, Lynn, was making some experiments last Friday afternoon in the manufacture of acetylene gas in an outhouse at the rear of his father's premises. The generator was of the usual pattern, but the holder consisted of iron plates made into a box and soldered, having a piece of tubing attached, without an ordinary burner, for testing the light. A lad who was with Mr. Burlingham was instructed to light this tubing, and instantly there was a terrific explosion. The top of the box was blown off, and fragments of the shattered iron struck Mr. Burlingham in the throat, fracturing his jaw. He was also struck on the temple. Death was instantaneous. The lad recovered after being unconscious for a time, and was found to be totally deaf.

Okehampton Water Supply.—The Okehampton Town Council have resolved to apply to the Local Government Board for sanction to borrow £1200 for the extension of the town water supply. The plans have been approved, and as soon as the loan has been obtained the work will be proceeded with.

The Quality of the Chelsea Water Supply.—A report on the examination of the water supplied by the Chelsea Water Company from November, 1897, to November, 1898, with some observations on the suitability of the Thames as a source of supply for London, has been presented to the Chelsea Vestry by Dr. Louis C. Parkes and Dr. S. Rideal. The conclusions arrived at by these gentlemen are stated as follows: "The results of our examinations appear to us to show that, even in a year exceptionally favourable to the purifying operations undertaken by the Water Companies, the element of danger necessarily attaching to the supply of a water taken from sources inevitably exposed to contamination is not by any means invariably eliminated by the methods of purification at present relied upon. A system of filtration which does not invariably keep out or destroy the common accompaniments of sewage and animal pollutions may, on the occasion of epidemic prevalences in communities on the river banks above the Companies' intakes, also allow the passage of the infective disease organisms in numbers sufficient, as the case may be, to cause epidemics among the water consumers, or mere sporadic outbreaks, or isolated occurrences among the more susceptible of the population. We are therefore of opinion that considerations of public safety require that reliance should not be placed upon sand filtration, as at present conducted as the sole means of defence when the water to be operated upon is derived from a tainted source."

The Poll on the Gas-Works Purchase Question at Reigate.—The result of the poll on the question of the purchase of the Reigate and Redhill Gas Companies' works by the Corporation has been announced, as follows: Against, 3542; in favour, 1329—majority against, 2213. About 4300 papers were distributed; and of these some 3600 were collected. A great many of them were, however, not marked; the number not counted amounting to about 700. Commenting on the result of the poll, the "Surrey Mirror" expresses regret at the decision of the ratepayers against the municipalization of the gas-works—a decision which it believes posterity will deplore. One reason assigned for it is that a considerable number of independent private residents were influenced in their voting by a distrust in the ability of the Corporation—who, it appears, are "divided by ward and personal differences"—to manage the gas supply with advantage and success; another, that the purchase of the gas-works would mean the postponement of the introduction of electric lighting. The writer consoles himself with the reflection that what has happened will rather tend to hasten its introduction, and materially improve its prospects of success. But he says the Gas Companies may "rest assured that the new illuminant will not interfere with the prosperity of their undertakings, and that if competition does result in cheaper gas and in a better supply, the increased consumption, which is inevitable, will amply compensate them for any concessions they may, in the future, find themselves compelled to make."

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The Acetylene Industry in England.—The balance-sheet of the Midland Acetylene (Parent) Syndicate, Limited, of Cradley Heath, shows a loss for the twenty months' trading ended Oct. 31 of £6418. The Directors state that only within the past few weeks have the Company been in a position to produce carbide of calcium in sufficient quantities to meet expenses, and to justify a hopeful view of the prospects of the concern. The chief cause of this state of affairs is said to have been the delay in the delivery of the new machinery. Now, however, the prospects are stated to be good.

Barry Water Supply.—Mr. James Mansergh has reported to the Barry District Council upon the source of their water supply at Biglis. There was a temporary lowering of the rest level by 3 ft. 9 in. from June to October which caused the authorities some little anxiety; but Mr. Mansergh does not regard it as in any way indicating failure of the supply. He considers that the supply has proved reliable up to 500,000 gallons per day as a minimum. The consumption in the district, however, will soon exceed the powers of the well in the summer months. Consequently he thinks it will be prudent to seek to augment the quantity at command by increasing the zone which contributes directly to the present supply, and a well should be sunk near the existing one. The water is shown to be of a high standard of purity. Its obvious defect is its hardness, amounting altogether to 33·8°, of which 22·4 is temporary hardness; and it could be softened with great advantage.

Proposed Water Supply for Headcorn.—An application by the Hollingbourne Rural District Council to the Local Government Board for power to borrow £3755 to provide a water supply for Headcorn and the adjoining hamlet of Grafty Green was the subject of an inquiry by Colonel A. G. Durnford on the 2nd inst. Considerable interest was taken in the proceedings; the scheme being opposed by some of the ratepayers, as well as by the South Kent Water Company. The cost of the proposed works was estimated at £3754, made up principally of £1000 for land, £1600 or £1700 for supply-pipes, and £400 for a reservoir. The Medical Officer of Health for the Hollingbourne district gave evidence to the effect that a good water supply was needed; Mr. A. J. Burrows said the work could be carried out for the amount estimated; and Mr. E. K. Burstal described the source of the supply as eminently satisfactory. His estimate for the whole proposal, including the buying of land, amounted to £3941. The repayment of this amount in forty years, including principal and interest, meant £170 5s. per annum. To his mind, the scheme seemed the most economical and best for the provision of a limited supply of water. For the opponents, it was contended that the estimates were misleading; and it was stated that the general feeling of the inhabitants was against the scheme. Mr. F. L. Ball, Secretary to the Mid-Kent Water Company, said a full supply to Grafty Green would cost £35 if furnished by his Company. Mr. E. Easton and Mr. De Rance thought the South Kent Company, who were now obtaining water from the Mid-Kent Company, would themselves shortly be in a position to supply water to the places proposed to be served by the Council. At the close of the inquiry, the Inspector announced that he would view the site of the proposed scheme the next day.

Reductions in Price.—The Directors of the Bath Gas Company intend to reduce the price of gas from 2s. 6d. to 2s. 4d. per 1000 cubic feet after the current quarter; and additional discounts of 2½ per cent. and 5 per cent. respectively will be given to consumers of 1 and 3 million cubic feet in any one year. The Hadlow Gas Company will reduce their price from 6s. 8d. to 5s. 10d. per 1000 cubic feet from the 1st of January next. Under the new arrangements with the Corporation of Ramsgate, the price of gas at Minster, which has hitherto been 3s. 9d. per 1000 cubic feet, will be reduced to 3s. 4d.

New Joint-Stock Companies.—The Crawley and District Water Company has been incorporated with a capital of £30,000, in £10 shares, for the supply of Crawley and the district with water, under the provisions of an Act obtained last session. The Sea-Water Works Construction Company, Limited, with a capital of £100,000, in £1 shares, has been formed to adopt and carry into effect an agreement made between the London Sea-Water Supply Company of the one part and the Company of the other; to contract for the construction, provision, and maintenance of all plant and machinery necessary for the supply of sea and fresh water to any cities, towns, and villages in the United Kingdom, America, or elsewhere; to build and maintain reservoirs, canals, embankments, waterworks, pumping-stations, cisterns, pumps, culverts, filter-beds, &c.; to acquire and turn to account any patents, patent rights, and inventions, &c. A Company has been formed under the title of Simmance and Abady, Limited, with a capital of £10,000, in £1 shares, to "enter into an agreement with J. F. Simmance and J. Abady, and to acquire, own, and work British patents No. 11,202 of 1896 and No. 7243 of 1897 for penny-in-the-slot and penny and shilling (combined) gas-meters.

Southwark and Vauxhall Water Company.—The report of the Directors of this Company for the six months ending Sept. 30 states that the number of new domestic supplies brought into charge during the half year was 737, estimated to produce an increased annual rental of £1804; and, in addition, the income derived from meter-rents and other sources shows a most satisfactory increase on the corresponding period of past years. The Directors say it has been a gratifying result that during the recent long season of drought the Company were not only able to afford an abundant supply of water in their own district, but to very materially assist another Company, who had found themselves temporarily unable to give so abundant a supply as usual. The Directors remark on this circumstance: "To place your Company in this position, no less than nine Bills have been promoted in Parliament since 1884, of which six have been successful, one was withdrawn, and two did not receive the approval of Parliament, but the main features of which were introduced in Bills in the following year, and were successfully carried through. While thus congratulating the shareholders, your Directors cannot forget that these necessary powers have only been obtained after the most determined opposition by the London County Council and their predecessors, and, consequently, at heavy expense; but they contrast with great satisfaction the present position of the Company and the supply afforded to their district with what it might have been had this persistent obstruction been permitted to prevail."

About 5000 Inclined Retorts are now in operation in England; and the
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But the "gist to be grasped" is that there have been NO COMPLAINTS about Poor Heats, or Imperfect Carbonizing, since the New Conveyor Company, Limited, appointed a HIGHLY SKILLED PRACTICAL FURNACE and RETORT EXPERT to Superintend this Department.

Official Inspection of Gas-Fittings, &c., at Bolton.—At a recent meeting of the Gas Committee of the Bolton Corporation, they resolved to appoint a person whose duty it will be to visit consumers within the gas limits of the Corporation and make inquiries as to their supply of gas. He will ascertain what complaints, if any, there are, and will also carry with him gas-burners for replacing, at a very small cost, those which are old and worn-out.

The Godalming Water-Works Purchase Question.—The poll taken at Godalming on the water-works purchase question has resulted as follows: In favour of purchase, 787; against, 778. As the voting was on the cumulative system, not much more than half the electorate polled; and as the narrow majority of 9 does not give a very decisive answer to the question, it is doubtful whether the purchase will be effected. It is understood, however, that the Town Council will proceed with the Bill, for which notice has been given.

Mid-Kent Water Supply.—The new deep well that the Mid-Kent Water Company have been sinking at their Halling works is now almost completed; and there is little doubt that when it is finished the Company will have from both sources a supply of not much less than 100,000 gallons per hour. The water has been pronounced of the highest possible purity; and the source being about 400 feet deep, pollution is considered impossible.

Important Find of Cannel at Abram.—According to a Wigan paper, the sinkings in connection with the new pits of the Moss Hall Coal Company at Abram have been fully justified; success having been attained almost beyond the most sanguine expectations. Recently a seam of cannel, 6 feet in thickness, was met, forming, it is believed, part of the Abram bed of cannel, which, by reason of its richness in gas producing qualities, is regarded as one of the most valuable in the market.

Doncaster and the Derwent Water Scheme of Sheffield.—A Special Water Committee of the Doncaster Corporation have prepared a report on the subject of the negotiations with the Sheffield Corporation with reference to obtaining a supply of water from the Rivers Derwent and Ashop for Sheffield, Rotherham, and Doncaster. The Committee ask the Council to approve of this principle: That if Doncaster is to have a part in the liabilities of the proposed undertaking, they shall also be entitled to a proportionate share in the ownership and management.

Resumption of the Constant Supply in East London.—The Secretary of the East London Water Company (Mr. I. A. Crookenden) notified to the various Local Authorities in the Company's district on Monday last week the intention of the Directors to resume the constant supply of water as from the 7th inst. He explained that it was necessary, for engineering purposes, that it should be carried out by sections, and that this would be done in accordance with the following table: Dec. 7, Poplar, Bromley, Millwall, Limehouse, Ratcliff, Loughton, Chingford, Chigwell, and Buckhurst Hill; Dec. 10, Bethnal Green, Bow, Woodford, Wanstead, and Ilford; Dec. 12, Hackney, Whitechapel, Shoreditch, City, Wapping, East and West Ham, and North Woolwich; Dec. 14, Mile End Old Town, St. George's-in-the-East, Walthamstow, and Leyton. The curtailment of the supply commenced on the 22nd of August.

An Artesian Boring at Werrington.—The Great Northern Railway Company have recently had an artesian tube-well bored at Werrington, near Peterborough, with the result that an excellent overflow, rising to the height of 20 feet above the surface, has been obtained. This boring, which has been carried out by Messrs. Le Grand and Sutcliff, goes to the depth of 132 feet; and the water coming from the Lincolnshire Limestone overflows at the rate of no less than 300,000 gallons per diem, which copious yield may have a material bearing upon the locomotive supplies of the district. The boring passes through the Oxford clay, great oolite clays, and stone, the upper estuarine beds, and finally the Lincolnshire limestone, from which the supply is derived The water will be pumped into a tank at a distance of about two miles from the source; and for this purpose it is intended to put down two compound duplex pumps (Blake-Knowles system), the order for which has been placed with the Hydraulic Engineering Company, Limited, of London and Chester.

The Steam-Roller at Work at Cardiff.—At the meeting of the Public Works Committee of the Cardiff Corporation, held last Thursday, Mr. Harpur read a letter from the Cardiff Gas Company complaining that several pipes had recently been broken by the steam-roller being used over the roads, and stating that it was a wonder a serious explosion had not occurred owing to the escape of gas which had resulted from the breaking of the pipes. They had at once seen to the matter, and all the pipes were mended, and they would be glad to hear what the Corporation would be willing to do to compensate them for the outlay necessitated. The Borough Engineer (Mr. W. Harpur) reported that he had written to the Company, pointing out that when the pipes were put down it was known that much of the ground had been made, that subsidences were bound to take place, and that the Company should therefore have taken steps to see that their pipes were well laid. As for the use of the steam-roller, this was now recognized as the proper thing to make the roads with. The Committee approved of Mr. Harpur's action.

Gas and Electric Lighting in St. Pancras and Islington.—At a recent meeting of the St. Pancras Vestry, Dr. Walter Smith, the Chairman of the Electricity and Public Lighting Committee, submitted a detailed statement concerning the cost and number of electric arc and gas lamps in the parish, and the amount of the lighting rate before and since the introduction of street lighting by means of arc lamps. The charge for arc lamps from 1892 to the end of 1894 was 6d. per unit, inclusive of all capital charges, repairs, maintenance, and interest and instalments of loans. In 1895 it was reduced to 5d. per unit; while the present cost (for 1898) is stated to be about £33 per arc lamp per annum—being equivalent to a charge of 3¾d. per unit. Dr. Smith states that one arc lamp displaces 5·4 gas-lamps; but "the standard of light is about eleven times greater." The lighting rate during the years in question was: 1892 and 1893, 2¼d.; 1894 and 1895, 3d.; 1896 to 1898, 2¼d. At a recent meeting of the Islington Vestry, some questions were asked on the same subject. In reply, the Treasurer stated that there were 216 arc lamps in the district, and that the total cost was £6822 per annum, or £40 17s. 1d. per lamp. These lamps had displaced 440 gas-lamps, which formerly cost £1747 per annum for gas, or an average of £3 19s. 5d. per lamp.

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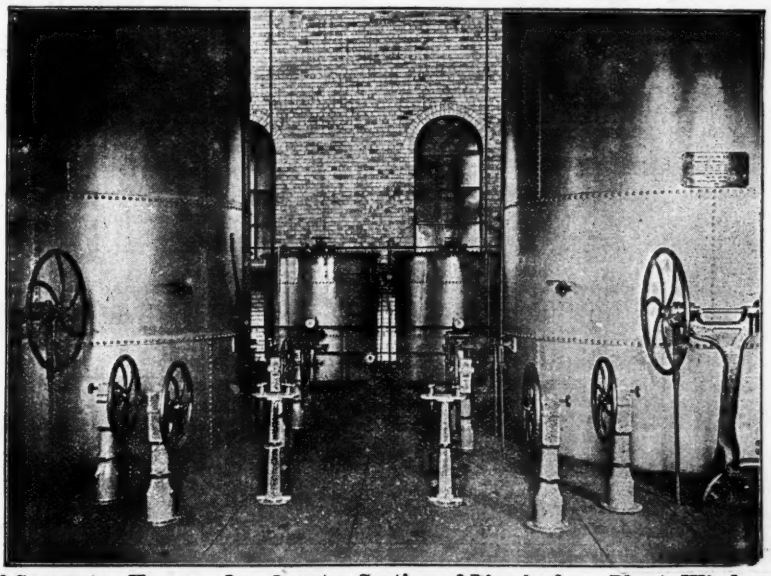

RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.
The Maximum Daily Capacity of the Birmingham Corporation's Plant, which was erected by this Company, is 10 MILLION CUBIC FEET.

The Cobham Gas Company's Undertaking.—At an extraordinary general meeting of the Cobham Gas Company, Limited, held last Tuesday, an agreement recently entered into by the Directors with Mr. E. Oxenford Preston, relating to the sale of the Company's works and undertaking, was approved.

The Quality of the Belfast Water Supply.—In addition to the reports on the above subject, to which reference was made in the "JOURNAL" last week (p. 1313), one has been received from Dr. Percy F. Frankland, F.R.S., in which he says "it appears to be in the highest degree improbable that the typhoid epidemic now prevalent in Belfast should be chargeable to the water as sent out to the consumer." The Commissioners have spent a good many thousands of pounds in the construction of filter works; and they have been described by Dr. Frankland as equal to any in the United Kingdom. Further, very close attention has been paid to the farmsteads in the various catchment areas. In connection with the Mourne scheme now under construction, the Commissioners have purchased the whole catchment, so that there can be no chance of injury to the natural purity of the water.

Stafford Gas Supply.—There was no opposition to the application made by the Corporation of Stafford to the Local Government Board for power to borrow an additional £5000 for gas-works purposes, which was recently the subject of an inquiry by Colonel W. L. Coke, and at which the Chairman of the Gas Committee (Alderman C. H. Wright) and the Gas Engineer (Mr. J. F. Bell) were present. The Town Clerk (Mr. M. F. Blakiston) explained that the application was made under the Provisional Order of 1891, which sanctioned the borrowing of £20,000, of which the Corporation had raised £15,000. The works were acquired in 1878, and since that date about £31,000 had been applied in reduction of the rates. The works cost £71,545, some £30,000 of which had been repaid. The price of gas in 1878 was 4s. 2d. per 1000 cubic feet, *plus* meter-rents; but now the average was 2s. 6d. with no meter-rents. The loan proposed was required for extensions of mains, the reconstruction of the sulphate of ammonia plant, and the erection of a boundary wall.

Great Fire in New York.—A disastrous fire, said to have been caused by an explosion of gas, took place on the night of the 4th inst. in Lower Broadway, New York. It originated in a clothing establishment at the corner of Broadway and Warren Street, and this building was destroyed. The Home Life Insurance building, fifteen storeys high, which was contiguous on the southern side, had its eight upper storeys gutted. The correspondent of the "Standard" says that perhaps never before was a fire reported where buildings were destroyed from the eighth to the fourteenth storeys without any material damage being done below the eighth, where the roof is usually found, and where the firemen neglected the danger of the flames spreading sidewise to stop their downward extension. Mr. Bonner, the Chief of the Fire Brigade, whose report on the advisability of having auxiliary water-mains for fire extinction is to be noticed later on, thinks this demonstrates that no building should be permitted to exceed 200 feet high, since above 125 feet the hose becomes increasingly ineffective, independent of the difficulty of getting it to that altitude.

Fatal Gas Explosion at Preston.—During the changing of a purifier in the gas-works of Messrs. Harrocks, Crewdson, and Co., at Preston, on the 28th ult., the water-seal was blown, and the gas escaped. This coming in contact with a light in the retort-house, an explosion occurred which wrecked the purifier-house, and seriously injured three men, who had to be removed to the Infirmary, where one of them succumbed. An inquiry into the circumstances was held on the following Saturday, when a verdict of "Accidental death" was returned; a rider being added to the effect that, in future, the purifier-house should be open at the sides and ends.

Reading Water Supply.—A special meeting of the Reading Town Council was recently held to consider a report from Mr. Oswald Brown on an estimate prepared by the Manager of the water-works (Mr. A. T. Walker) of a scheme for improving the water supply of the district. It is proposed to construct at Tilehurst a reservoir, the floor of which will be about 327 feet above Ordnance datum, 32 feet higher than the top of the present stand-pipe at the Whitley tank, and 54 feet above the highest point at present supplied. It will have two compartments, each about 150 feet square and 20 feet deep; containing when full about 2,600,000 gallons each. The floor is to be of concrete, the walls of brickwork, and the roof of brick arches supported on brick columns; the whole reservoir being surrounded and covered with a bank formed of the material derived from the excavation. Mr. Walker's estimate for the reservoir was £17,420. Mr. Brown put it at £17,700. The Council were asked by the Water Committee to sanction an application to the Local Government Board for power to borrow £50,000 for water-works purposes; and this was done. Agreements have been entered into with the Caversham and Goring District Councils for furnishing them with a supply of water by meter.

Death from Gas Poisoning at Hull.—A labourer named Samuel Winn, in the employ of the British Gaslight Company, died on the 29th ult. under somewhat peculiar circumstances. He and another man were laying pipes, and in the course of the work they, as usual, inserted a bladder into the end of a pipe, and inflated it to prevent leakage. A few minutes later, finding that gas was escaping, Winn returned to re-inflate the bladder. His companion subsequently found him lying unconscious on the footpath with his mouth to the inflating tube. A doctor was sent for and restoratives were applied, but in vain, for death took place within a couple of hours. An inquiry into the circumstances was held next day by the City Coroner, when Mr. J. R. Warren, the Company's Chief Inspector, who had visited the scene of the accident, said he found the bladder in its place and doing its proper work. It was not defective, or it could not have been used the whole day. There was no escape of gas. Asked by the Coroner how he thought the accident had occurred, witness said he had no idea; it was a most mysterious thing. This was the first death of the kind he had known in the Company's history. Mr. G. T. Hartley deposed to seeing the deceased on the morning in question. He was lying on some bags, and was dead. Witness had found on examination that all the internal organs were stained red. In his opinion, death was due to carbonic oxide poisoning, caused by inhalation of coal gas. A verdict of "Accidental death" was returned.

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The Sandwich Gas Undertaking.—The Local Government Board have sanctioned the borrowing of £2290 by the Sandwich Town Council for the purposes of the Corporation gas undertaking; and the Public Works Loan Commissioners have agreed to advance the amount at 2¾ per cent., repayable in 25 years.

The Proposed Purchase of the Bishop's Stortford Gas-Works by the District Council.—The negotiations which have for some time past been carried on between the Bishop's Stortford District Council and the Bishop's Stortford Gas Company, Limited, with reference to the purchase of the gas-works have now fallen through.

The Guildford Corporation and the Late Water Engineer.—Some months ago, circumstances arose which led to the severance of the connection between the Guildford Corporation and their Water Engineer (Mr. C. H. Adams); and subsequently legal proceedings were instituted by him against the Corporation. At a recent meeting of the Town Council, a letter was read from Mr. Adams's Solicitors, announcing that, on the ground of ill-health, he had decided to abandon the action.

The Extensions of the Goole Gas-Works.—The majority of the members of the Goole District Council visited the gas-works last Thursday to inspect the additions and alterations to the plant, which have been made at a cost of above £3000, from the specifications, drawings, and designs of Mr. Matt Dunn, the Gas and Water Manager. The party were conducted by Mr. Dunn; and at the close of the inspection, refreshments were provided by Mr. T. C. Turton, Chairman of the Gas and Water Committee. Congratulatory speeches were made on the success which has attended the Council's departure in the erection of new works, and the excellent manner in which the Manager has carried them out.

The Stockport Corporation and the Water-Works.—By a practically unanimous resolution, the Stockport Corporation recently decided to acquire the undertaking of the Stockport Water Company; and their action was endorsed at a meeting of ratepayers held on the 2nd inst. The question was under consideration in 1886; but the proposal was dropped because it was thought that it would entail a rate of 1s. 2d. in the pound. Since then, however, the income of the Company is stated to have increased 50 per cent.; and though the price now proposed to be given is £200,000 more than it was in the above-named year, it is believed that the income will continue to augment, and that the undertaking will prove successful. A statement, prepared by the Borough Treasurer (Mr. H. Grundy), has been published, showing that the annuities, interest, and working expenses will come to £36,825; while the income for the first year will be only £35,500—leaving a deficiency of £1325. But assuming that only the same annual increase of income is maintained as during the past seven years, he estimates that a rate of 1½d. in the pound for a few years will suffice to meet this deficiency and the contributions to the sinking fund when they fall due.

Gainsborough Gas-Works Purchase Bill.—A statutory meeting of the Gainsborough District Council was held last Wednesday, for the purpose of passing a resolution to promote a Bill in Parliament for the purchase of the undertaking of the Gainsborough Gas Company, and empowering the Council to supply gas within Gainsborough and the adjoining parish of Morton. (A notice of the proposed Bill appeared in our "Parliamentary Intelligence" on the 29th ult.) In the course of the discussion, Mr. Pearson and Mr. Barlow expressed some doubt as to the purchase being altogether desirable; and both argued in favour of electricity. Mr. Housham held that, if the Council wanted to supply electricity, the best thing to do was to first acquire the gas-works. The Clerk stated that he found from a Parliamentary Return that 80 Urban Councils had bought their gas undertakings; and up to December last 68 had made an aggregate profit of £102,035, while the remaining 12 experienced losses amounting in the total to £1471. The Lincoln Corporation had put by a reserve fund of £50,000 since 1885, in addition to reducing the price of gas, abolishing a 4s. annual meter-rent, and giving £1500 towards the rates out of the profits of the gas undertaking. The Gas Company were pledged not to oppose the Bill. Eventually the resolution was carried, no hands being raised in opposition, although three members were neutral.

The Price of Gas at Cambridge.—In the course of a discussion on the public lighting contract at the meeting of the Cambridge Town Council last Thursday, a letter was read from the Secretary of the Gas Company (Mr. A. E. King), in which it was stated that, after very careful consideration, the Directors had, owing to the increase in the price of coal and the cost of manufacture, decided to revert to the charge of 3s. per 1000 cubic feet of gas, and that consequently the present price to the Corporation could not be continued after the end of this month. The present price, we believe, is 2s. 10d.

Residual Products Manufacture and Gas Purification in Manchester.—The Gas Committee of the Manchester Corporation last Friday appointed a Sub-Committee to consider two matters—first, whether the manufacture of residual products will cause any nuisance; and, secondly, can such manufacture be carried on to the financial benefit of the ratepayers? The Committee also had under consideration the desirableness of further purifying the gas manufactured by the Corporation, more particularly with regard to the excessive amount of sulphur it is stated to contain. It was decided to take effective measures to reduce this form of impurity.

Proposal to Employ Vagrants at the Stafford Gas-Works.—A curious question has arisen between the Gas and Electricity Committee of the Stafford Town Council and their workmen who are members of the Gas Workers' Union. It is proposed to adopt in Stafford the Church Army scheme for the employment of vagrants; and at a meeting in connection with this scheme Mr. J. F. Bell, the Corporation Gas Engineer, stated that vagrants could be employed without interfering with the regular workers. The branch of the Trade Union referred to have protested that such a scheme will lower wages, and is unfair to local out-of-work labourers; and the matter was brought before the Town Council last week. Mr. Bell explained that the vagrants would not be paid wages, and the idea was to help men passing through the town without sending them to the workhouse. On the Council are several Trade Unionists; but, in addition, an alderman was opposed to the scheme. The men point out that Mr. Bell and the Church Army people are on the horns of a dilemma, for if there is work waiting to be done, there are men in the town wanting it; but if there is not, the Committee must be making work, and burdening the rates to maintain foreign workmen or pauper vagrants.

The Manchester Corporation Gas Committee and the Workmen's Compensation Act.—At the meeting of the Manchester City Council last Wednesday, the minutes of the Gas Committee contained a resolution approving of the settlement by the Town Clerk of a claim for £150 made under the Workmen's Compensation Act by the widow of Samuel Nicholls, who was accidentally killed at the Rochdale Road station; a second resolution ordering the payment of £25 to James Cleland, father of John Cleland, a workman accidentally killed at the Bradford Road works. In this case, the verdict of the Jury was "Accidental death, with contributory negligence on the part of the deceased." Alderman Gibson, replying to Mr. Brocklehurst, stated that the claim of £150 made by the friends of Mr. Nicholls was paid at once, without any demur or further consideration by the Committee. In the other case, the father explained to them that he had come all the way from Belfast to bury his son. It had cost him £25 altogether, and he said he would be glad if they could give him something towards his expenses. They at once gave him the whole £25. Mr. Brocklehurst moved that the proceedings should be referred back to the Committee for reconsideration, on the ground that they had not done all they ought to have done. It was hardly creditable to a Corporation like that of Manchester to take advantage of the ignorance of working men, who evidently were not aware of the amount they had a right to claim under the Act. Mrs. Nicholls was entitled to a sum equal to three years of her husband's wages; and, as these wages were 33s. a week, the sum handed over to her should have been £257 8s. Alderman Gibson denied that the Gas Committee had taken any undue advantage of the people's ignorance. The matter had been settled with the claimant's lawyer and not the claimant personally. After further discussion, during which it was held that, inasmuch as the claims referred to had been duly settled, the amendment was out of order, Mr. Brocklehurst withdrew it.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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Telegrams: "HUTCHINSON BROS., BARNSLEY."

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WANTED, on Dec. 31, 1898, a Young MAN capable of laying Mains and Services for a Water Company. Salary, 25s. a week. Good References required.
Apply to A. HAROLD RUSTON, Secretary, Newmarket Water-Works Company, Ltd., NEWMARKET.

WANTED, a good Stoker, used to Shovel Charging, Generator Furnaces, and Engine and Exhauster. Permanency. Abstainer preferred. Wages 30s. per week.
Apply, with Reference, stating Age, to F. W. TORPEY, Gas-Works, WHITWICK.

WANTED, an experienced Draughtsman. One accustomed to Gas Plant preferred. Permanency to a good Man.
Apply, by letter, stating Experience, Age, and Salary required, to No. 3181, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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WANTED, an experienced, steady YOUNG MAN, to lay Gas-Mains, under Supervision, in Country. Three Months' job; and if a Service Layer, possibly a permanency.
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THE Directors of the Aldershot Gas and Water Company require the services of a SECRETARY and ACCOUNTANT, who must be thoroughly acquainted with all the duties appertaining to the Office. Salary £250 per annum.
Applications, with three recent Testimonials, to be forwarded by the 13th of January, 1899, addressed: HONORARY SECRETARY, Gas and Water Company, ALDERSHOT.
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[For Illustrated Advertisement, see Dec. 6, p. 1274.]

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Reply immediately, enclosing Testimonials, stating Age, Experience, Salary expected, and when at liberty to undertake the work, to William Wilson, Contractor, New Gas-Works, Granton.
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(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply and construction of Two 25 feet square and 6 feet deep PURIFIERS, with necessary Valves and Connections.
Further Particulars may be obtained from the undersigned.
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Gas Offices, Fenton,
Dec. 7, 1898.

THE Directors of the Worksop Gas Company invite TENDERS for the purchase of the surplus TAR and the AMMONIACAL LIQUOR made at their Works from the 1st of January to the 31st of December, 1899.
Tenders for Tar to state Price per ton delivered into Purchaser's Tanks at the Worksop Railway Station.
Tenders for Liquor to state Price per ton as tested by Twaddel's No. 1 Hydrometer, delivered into Boats near the Company's Works; or price per ton delivered into Purchaser's Tanks at the Railway Station.
The Directors do not bind themselves to accept the highest or any Tender.
Tenders to be sent in by the 31st of December.
Worksop, Dec. 8, 1898.

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THE Directors of the above Company are prepared to receive TENDERS from Ironfounders, Gun-Barrel Manufacturers, Timber Merchants, Druggists, Ropemakers, &c., for GOODS to be delivered on the Company's Works, Great Brunswick Street, in such Quantities as may be required from time to time up to the 31st of December, 1899.
Samples of Goods required are open to inspection on the Works, Great Brunswick Street; and printed lists of Articles required can be had on application at the Company's Offices, D'Olier Street.
Tenders, endorsed "Tenders for Stores," to be lodged in my Office on or before the 21st inst.
FRANCIS T. COTTON,
Secretary.
D'Olier Street, Dublin,
Dec. 8, 1898.

STRETFORD GAS ACT, 1877.

THE Directors of the Stretford Gas Company hereby intimate that it is their intention to submit FOR SALE BY TENDER, on Thursday, the 22nd day of December next, at the Offices of the said Company, in Stretford, 1100 of the NEW "A" £10 SHARES, upon which the Dividend payable is not to exceed 7 per cent.

Forms of Tender and Conditions may be procured from the Secretary of the Company, Mr. BENJAMIN HAYNES, Gas-Works, STRETFORD.

Nov. 30, 1898.

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(GAS DEPARTMENT.)

TENDERS invited for 2500 (12-feet lengths) 6-inch GAS-PIPES, 500 4-inch GAS-PIPES, together with about 5 Tons of BENDS, BRANCHES, &c.

(WATER DEPARTMENT.)

Also for 375 4-inch and 125 3-inch WATER-PIPES, in 12-feet lengths; and about 4 Tons of TEES, BENDS, &c.

Tenders to be sent in addressed to the Chairman of the Gas and Water Committee, Hardres Street, not later than Dec. 31, endorsed "Tender for Pipes."

The Committee do not bind themselves to accept the lowest or any Tender.

Specification and full Particulars on application to

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Engineer.

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Plans, Specifications, and full Particulars on application to

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TENDERS are invited for the con- struction of a concrete GASHOLDER TANK, 95 feet diameter by 26 feet deep.

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Tenders, endorsed "Gasholder Tank," to be addressed to the Chairman of the Company, 98, High Street, Newport, I.W., and delivered on or before Saturday, Jan. 7, 1899.

The Directors do not bind themselves to accept the lowest or any Tender.

FRANK KING,
Secretary.

Newport, Isle of Wight,
Dec. 6, 1898.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCK, WILL BE CLOSED at Ten o'clock forenoon, on Friday, the 9th inst., for the Half Year ending the 31st of December, 1898, and will be RE-OPENED on Friday, the 16th inst.

The Interest for the Half Year will be payable on the 1st of January next to the Proprietors registered on the closing of the Books.

By order of the Board,
JAMES RANDALL,
Secretary.

Gas Offices: Willoughby Lane,
Tottenham, Dec. 2, 1898.

STAINES RESERVOIRS JOINT COMMITTEE.

INCORPORATED BY ACT OF PARLIAMENT, 59 AND 60 VIC., CAP. 241.

ISSUE OF £500,000 £3 PER CENT. DEBENTURE STOCK.

MINIMUM PRICE, PAR.

Payment of Interest guaranteed by the three following Companies:—

The West Middlesex Water-Works Company,
The Grand Junction Water-Works Company, and
The New River Company, jointly and severally.

NOTICE is Hereby Given, that the Joint Committee are prepared to receive TENDERS for the above amount, being a further portion of the DEBENTURE STOCK created by the above Act and by the Act of 1898, bearing Interest at £3 per cent. per annum, payable Half Yearly, and redeemable after the expiration of 25 Years from the date of issue, subject to six Months' Notice being given by the Committee.

The Staines Reservoirs Act, 1898, authorizes Trustees to invest Trust Funds in this Stock.

Tenders must be delivered at the Office of the Committee, No. 19, Marylebone Road, N.W., not later than Two o'clock p.m., on Wednesday, the 21st of December next.

Particulars and Conditions, together with Form of Tender, may be obtained at the said Office, or will be forwarded on application; also of Messrs. Hollams, Sons, Coward, and Hawksley, Solicitors, 30, Mincing Lane, E.C.; and of Messrs. Prescott, Dimsdale, and Co., Limited, Bankers, 50, Cornhill, E.C.

By order of the Joint Committee,
F. H. WYBROO,
Secretary.

Office of the Committee:
19, Marylebone Road, London, N.W.,
Nov. 23, 1898.

ROCHDALE CORPORATION.

TO RETORT MAKERS AND OTHERS.

THE Gas Committee of the above Cor- poration invite TENDERS for the supply of such quantities of RETORTS and other FIRE-CLAY GOODS as may be required during the Year ending the 31st of December, 1899.

Forms of Tender and any further Information may be obtained on application to Mr. T. Banbury Ball, the Manager at the Gas-Works.

Tenders, endorsed "Fire-Clay Goods," must be sent to me not later than Noon on Wednesday, the 21st of December, 1898.

Contractors who intend to sub-let part of their Contracts must forward with their original Tenders a list of the Names of their Sub-Contractors.

By order,
JAMES LEACH,
Town Clerk, Rochdale.

Town Hall, Rochdale,
Dec. 8, 1898.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCK only, WILL BE CLOSED on the 19th inst., and RE-OPENED on the 2nd prox.

S. J. WILLIAMS,
Secretary.

63, Chancery Lane,
Dec. 10, 1898.

DEVONPORT WATER COMPANY.

FOURTH ISSUE OF £4 PER CENT. PREFERENCE STOCK, TO RAISE £10,000.

Part of a sum of £80,000 authorized by the DEVONPORT WATER-WORKS ACT, 1889, and of the sum sanctioned by the Stockholders at their Meeting held on the 30th of June, 1898.

FIRST PAYMENT OF INTEREST WILL BE MADE ON THE 25TH OF MARCH NEXT.

The Company having for more than Ten Years past paid a Dividend of £5 per cent. on its Ordinary Stock, the Preference Stock now offered is, under the Trustees Investment Acts, an available Investment for Trustees who are not expressly forbidden from investing therein by the Instrument (if any) creating the trust.

THE Directors of the Devonport Water Company are prepared to receive TENDERS for the sum of £10,000, or any part thereof in sums of £50 and upwards (being multiples of £10), free from all charges and expenses.

Tenders, stating the price per cent., which must not be below £125 per cent., should be sent, on the Form provided, to the Secretary, on or before the 31st of January next. Forms of Tender may be obtained at the Naval Bank, Plymouth or Devonport, or any of its Branches; or from the Secretary of the Company.

A Deposit of £5 per cent. on the amount tendered must accompany the Tender.

The Stock will be allotted to the highest bidders above the Reserve Price.

The Purchase Money for the Stock allotted will be payable as follows:—

Deposit on application . . . £5 per cent.
The balance on or before the 1st of March next, or on allotment.

If no allotment is made, the Deposit will be returned in full.

If Tenders for a larger amount of Stock than the total issue are received, those at the lowest price accepted will be subject to a proportionately reduced allotment.

In case of failure to pay the balance on the appointed day, the Deposit will be liable to forfeiture.

Stock Certificates under the Seal of the Company will be issued within one month after the 1st of March next for the Stock allotted.

Interest on the Stock purchased will be payable Half Yearly on the 25th day of March and the 29th day of September; the Interest payable on the 25th day of March, 1899, will accrue from the date of payment of the Balance.

The present issue is required to defray in part the cost of the construction of a new Service Reservoir and for the general purposes of the Company.

The Security comprises the Income from Water-Rates and other sources, which for the past Six Years have exceeded £12,000, and which are annually increasing.

The Stock of the Company already issued consists of the following:—

£84,800 0s.	Ordinary Stock
68,447 4	Preference Stock (£4½ & £4 p.c.)
18,250 0	Mortgage Debenture (£3 & £3½ p.c.)
Total £171,497 4s.	

The Stock to be issued will be entitled to a Preferential Dividend in Perpetuity over the Ordinary Stock; and will be subject to the powers of the Company under their Act of 1889, enabling them to borrow on Mortgage not exceeding £20,000.

Should the Profits of the Company at any time admit of a payment in excess of the Maximum due on its Stocks already issued, the Stock now offered will be entitled to an Increased Dividend up to £5 per cent.

FOSTER J. BONE,
Secretary.

23, Ker Street, Devonport,
December, 1898.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS.

By N. H. HUMPHRYS, Assoc M.Inst.C.E., F.C.S.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

THE Acetylene Illuminating Company, Limited, 63, Queen Victoria Street, London, E.C., GIVE NOTICE that they hold the BRITISH PATENT RIGHTS for the MANUFACTURE OF CALCIUM CARBIDE by means of the electric furnace, that they are bringing an action against the Midland Acetylene (Parent) Syndicate, Limited, to restrain them from so manufacturing that product, and that they intend in the future to bring actions against all infringers of these Patents and all purchasers or users of Carbide of Calcium made in infringement of the same.

NOTICE.

THE Acetylene Illuminating Company, Limited, having published and issued an advertisement or circular claiming that they hold the British Patents for the Manufacture of Calcium Carbide by means of the Electric Furnace, we guarantee to indemnify anyone who buys Carbide from us against any claim by "The Acetylene Illuminating Company, Limited," or anyone else.

READ HOLLIDAY AND SONS, LIMITED, Acetylene Gas Engineers and Carbide of Calcium Manufacturers, HUDDERSFIELD.

NOTICE.

THE Acetylene Illuminating Company, Limited, having published and issued an advertisement or circular claiming that they hold the British Patents for the Manufacture of Calcium Carbide by means of the Electric Furnace, we guarantee to indemnify anyone who buys Carbide from us against any claim by "The Acetylene Illuminating Company, Limited," or anyone else.

TINKER AND HOLLIDAY, LIMITED, Carbide of Calcium Manufacturers, HAZELHEAD, SHEFFIELD.

THE ACETYLENE ILLUMINATING COMPANY, LTD.,

Manufacturers of Carbide of Calcium,
63, QUEEN VICTORIA STREET, LONDON, E.C.,
and FOYERS, SCOTLAND.

NOTICE.

MESSRS. Read Holliday & Sons, Ltd., of Huddersfield, and Messrs. Tinker, Holliday, & Co., Limited, of Hazelhead, Sheffield, having advertised that they are Manufacturers of Carbide of Calcium, and having guaranteed to indemnify anyone who buys Carbide from them, against any claim by the Acetylene Illuminating Company, Limited, Notice is Hereby Given by the Acetylene Illuminating Company, Limited, that they have been unable to secure any evidence, and do not believe, that either of the said Firms is, a Manufacturer of Carbide of Calcium.

The Acetylene Illuminating Company, Limited, for over two years, have been supplying Carbide to Messrs. Read Holliday & Sons. This Firm has, since advertising as above mentioned, ordered a further supply, which order the Acetylene Illuminating Company, Limited, have declined to execute in view of such advertisement.

On the Acetylene Illuminating Company, Limited, securing evidence that either of the above Firms, or any other Person or Firms are manufacturing or importing Carbide of Calcium, they will bring an action for Infringement of their Patent Rights.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

ENRICH YOUR GAS
WITH
CHEAP BENZOL.
AT to-day's Price of Benzol, Illuminating POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.
Apply to SADLER & CO., MIDDLESBROUGH.

DISPENSE WITH CANNEL COAL
and
INCREASE YOUR ILLUMINATING POWER
by using the
WHESSOE-MUNICH BENZOL CARBURETTER
The Cheapest and Best in the Market.
The Managers of Tynemouth, Middlesbrough, and Darlington Gas-Works are much pleased with it, and would not be without it.
Apply to the Sole Makers
THE WHESSOE FOUNDRY COMPANY, LIMITED, DARLINGTON.

HEBBURN MAIN GAS COALS.
Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.
For Prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
5 Lombard Street, NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

COKE-BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
With Elevators and Conveyors worked by Steam or Gas Engine.
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165, QUEEN VICTORIA STREET, E.C.
And at STROUD, GLOUCESTERSHIRE.

INCANDESCENT GAS LIGHTING.

Incandescent Burners from 5/6 per doz.
Specially annealed best Fireproof Glass Chimneys (equal to the Jena.) 1/4 per Doz.
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Write for Illustrated Price Lists.
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WELDON MUD
FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR,
ALSO
Removal of last Traces of SULPHURETTED HYDROGEN in catch position.
Full Particulars on application to the Patentees:
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NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
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LONDONDERRY GAS COALS
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COUNTY OF DURHAM.
Available output up to 5000 tons per day
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

BOLDON GAS COALS.
ANALYSIS.
Yield of Gas per ton . . 10,500 Cubic Feet.
Illuminating Power . . 16·9 Candles.
Coke . . . . . 66·7 Coke.
Sulphur . . . . . 0·86 Sulphur.
Ash . . . . . 2·04 Ash.
For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.
Telegraphic Address: "PARKINSON NEWCASTLE."

HOLMSIDE
GAS COALS.
Present Daily Produce over 5000 Tons.
Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation
Yield of Gas per Ton . . . 11,205 Cubic Feet.
Illuminating Power 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. per Ton.
Sulphur . . . . . A little over 1 per Cent.
Ash . . . . . Under 1 per Cent.
Tar . . . . . 163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor 103 lbs. (Avoir.) per Ton.
HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.
SOUTH MOOR
PELTON GAS COALS.
Present Daily Produce available 3000 Tons.
Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.
Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.
These Coals may be bought through the Principal Merchants in England, or direct from
MR. MARK ARCHER,
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PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.
For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.
Prices are Reduced.

HEATHCOTE GAS COAL.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.
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Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for
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TYNE
BOGHEAD
CANNEL.
Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles
Coke per ton . . . . . 1,301·88 lbs.
EAST PONTOP
GAS COAL.
Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.
SOUTH PELAW MAIN
GAS COAL.
Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.
For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE
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Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

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Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
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GAS ENGINEERS' AGENTS AND CONTRACTORS FOR
Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.
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WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
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Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 „
Ash	2·78 „

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

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STOURBRIDGE, ENGLAND,
MANUFACTURERS OF
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Will be pleased to send Sample Patterns and Prices to the Managers and Engineers of Gas Companies, similar to those which have been supplied by them to the South Metropolitan Gas Co., The Gaslight and Coke Co., Commercial Gas Co., and others, for 30 years past.

ALL KINDS OF STOUT LEATHER GLOVES FOR FURNACE OR SMELTING WORKS MADE TO ORDER.

THE
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PATENTED.

Specially constructed for use with the New Welsbach Chimneyless Burner.

Made with lever and chains, or with cock at bottom.

Fitted for One, Two, or Three Burners.

HIGHLY RECOMMENDED FOR STREET LIGHTING.
Wind, Rain, and Draught Proof.
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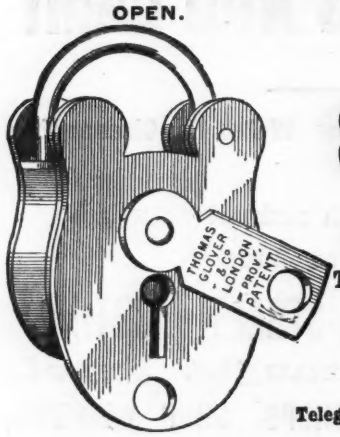

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Prevents Tampering with the

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The Padlock is Sealed by means of a Lead Eyelet, which is impressed with Company's private mark. Eyelets easily fixed and removed by Company's Collector.

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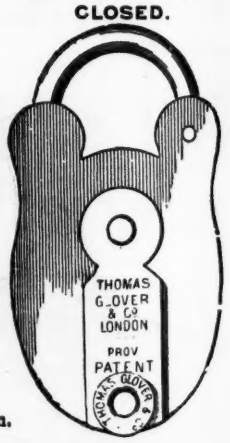

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MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address:* "GOTHIC." Telephone No. 3398.

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INCANDESCENT GAS LIGHTING

The disastrous effects of SHOCKS and VIBRATIONS may now be done away with by the use of

CLAY'S PATENT SHOCK-PROOF FITTINGS,

which are the next best thing to UNBREAKABLE MANTLES.

The Illustrations show two of our arrangements; but we are able to cope with all conceivable conditions or requirements.

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WARNING: As we hold the Master Patents covering the COILING OF SUPPLY-PIPES to obtain a resilient bearing to neutralize the damaging effect of Shock or Vibration on the Mantles of Incandescent Burners, we shall not hesitate to immediately INSTITUTE PROCEEDINGS AGAINST ANYONE INFRINGING OUR RIGHTS.

"C" BURNER SUSPENDED WITH BYE-PASS OVERHEAD.

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London Representatives: Messrs. H. GREENE & SONS, Ltd., 153 & 155, Cannon Street, E.C.

Telegrams: "CLAYS, BOLTON." **See Illustrated Advt. in "Journal," Nov. 30, 1897, p. 1155.**

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Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c., &c.

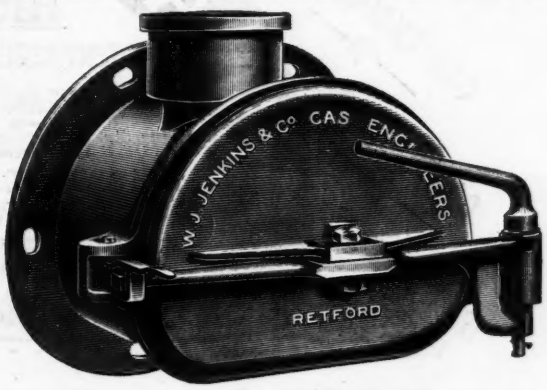
EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

London Agents: Contractors for the erection of Retort-Benches complete.

BALE & HARDY, **Gas Engineers and Contractors,** BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

MOUTHPIECES

WITH SELF-SEALING LIDS FOR HORIZONTAL AND INCLINED RETORTS.



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HISLOP'S PATENT REGENERATIVE RETORT-SETTINGS

THESE SETTINGS SECURE THE RECORD PRODUCTION OF

1000 CUBIC FEET OF GAS PER LINEAL FOOT OF RETORT (Ordinary Section) per 24 HOURS from ENGLISH COAL, and

1200 CUBIC FEET FROM SCOTCH COAL,

Together with every other possible Advantage.

DURABILITY AND SIMPLICITY OF MANAGEMENT. LOWEST POSSIBLE FUEL ACCOUNT. PERFECT SATISFACTION GUARANTEED.

All Enquiries to be addressed to the PRINCIPAL AGENT,

R. F. HISLOP, Gas Engineer, CRAIGIELEA, PAISLEY.

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"ST. ALBAN'S" STREET LANTERN

Specially adapted for Incandescent Street Lighting. Fitted with Steel Enamelled White Reflector.

The Illustrations show the Lantern fitted with the New No. 4 Welsbach Incandescent Burner and Patent Bye-Pass Tap, and Clay's Anti-Vibration Coil.

Write for Catalogue.

Lantern packed for Export, thus reducing Freight.

H. GREENE & SONS, LTD.

Gas Engineers and Lighting Contractors, Manufacturers, and Patentees,
Late 153 & 155, Cannon Street, London Bridge, E.C.

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Three Minutes' walk from Farringdon Street Station, Metropolitan Railway.

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RETORT BENCHES ERECTED COMPLETE WITH OR WITHOUT SPECIAL FURNACES.
RESULTS GUARANTEED.

OVENDEN HALIFAX

Designs and Estimates on Application.

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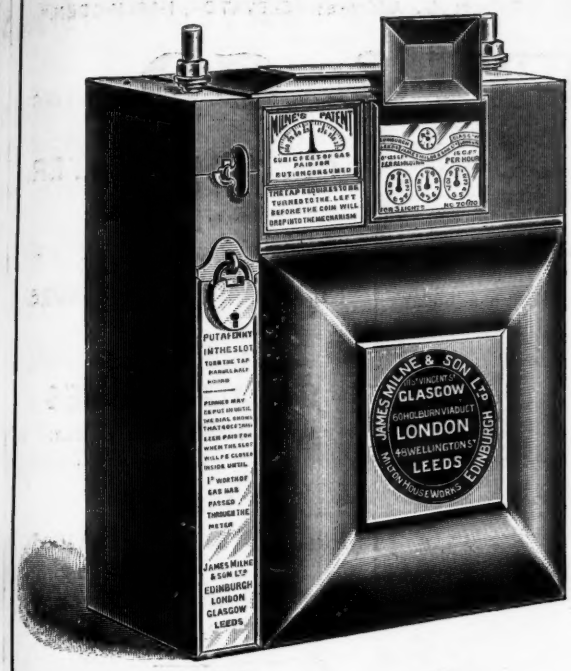

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MILTON HOUSE WORKS

EDINBURGH.

LONDON. GLASGOW. LEEDS.

MILNE'S PATENT PREPAYMENT DRY METER.

MOST compact Attachment in the Market.

Same Height as an Ordinary Meter.

Composite Attachment Cover, easily removable, with extra large Money-Box, which is withdrawn while opening Door.

Absolutely Positive in Action.

The Whole Mechanism always in Gear.

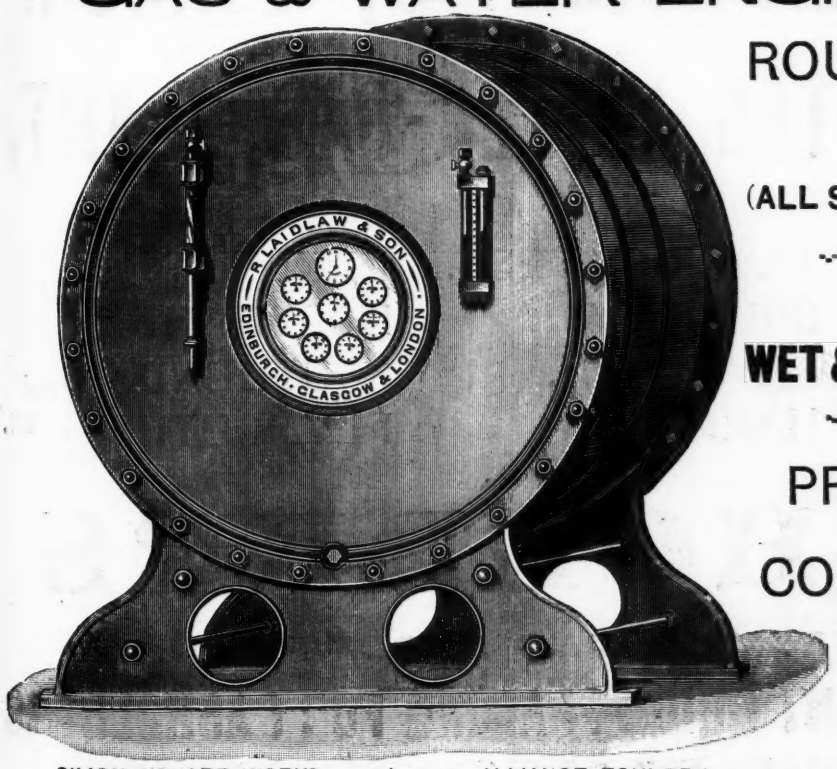
The following unsolicited comparison has been sent us as showing the exact correspondence of amount due per Index and Cash in Money-Box with these Meters as against those of other Makers:—

Milne's Meter	due per Index	3/4	Cash in Box	3/4
Milne's	,,	,,	4/2	,,	4/2
Milne's	,,	,,	2/6	,,	2/6
Milne's	,,	,,	3/4	,,	3/4
Milne's	,,	,,	2/6	,,	2/6
Two other Makers.	,,	,,	6/8	,,	6/11
	,,	,,	1/8	,,	2/0
	,,	,,	3/9	,,	5/2
	,,	,,	2/6	,,	2/8
	,,	,,	4/7	,,	6/0

Above Results confirmed on further comparison.

R. LAIDLAW & SON

GAS & WATER ENGINEERS.



ROUND OR SQUARE STATION (ALL SIZES) METERS.

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PREPAYMENT AND COMPENSATING METERS.

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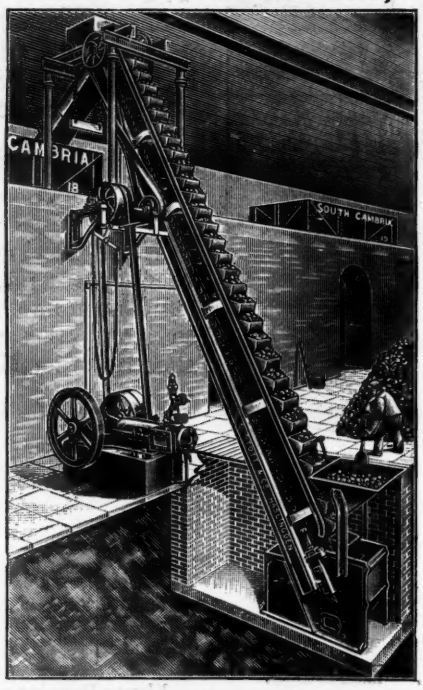

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HIGH-CLASS STEAM-ENGINES up to 1000-Horse Power.

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CARBURETTED WATER-GAS PLANT.

ADOPTED AT

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GASHOLDERS

OF EVERY SIZE AND DESCRIPTION.

CUTLER'S PATENT GUIDE-FRAMING FOR GASHOLDERS

HAS BEEN ADOPTED FOR MANY IMPORTANT HOLDERS.

IT IS STRONG AND CHEAP, AND REQUIRES NO PIERS FOR ITS SUPPORT.

MACKRELL BROS.,

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Manufacturers of

IMPROVED GAS-METER PERSIANS.

UNSURPASSED FOR QUALITY AND VALUE.

FOR WHOLESALE AND EXPORT TRADE ONLY.

WE OFFER IN BEST QUALITY:

Incandescent Mantles, transportable per 100	£1	15s. 0d.
,, ,, not heated ,, ,,	£1	2s. 0d.
Union Burners, suitable for all Systems ,, ,,	£3	0s. 0d.
Burners with Auer Top . . . . ,, ,,	£3	15s. 0d.
do. do. with bye-pass & chains ,, ,,	£8	15s. 0d.
Magnesia Forks . . . . . ,, ,,		2s. 6d.

CHIMNEYS AT LOWEST MARKET PRICES.

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SUPPLY FROM STOCK

CAST-IRON RETORTS

AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.

FLANGE PIPES FOR STEAM.

Sole Manufacturers of **LYON'S "PATENT" GAS-MAIN SYPHONS.**

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WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

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MACHINE-MADE GAS-RETORTS.

TO WHOLESALE DEALERS & EXPORT MERCHANTS ONLY.

INCANDESCENT MANTLES (transportable) per 100 . . .	£1 10s.
ENGEL'S "STANDARD" BURNER, for all Systems per 100 .	£2 15s.
MAGNESIA FORKS, per 100 2s.; per 1000	16s.

All of the very Best Quality.

Agents wanted, and Correspondence invited.

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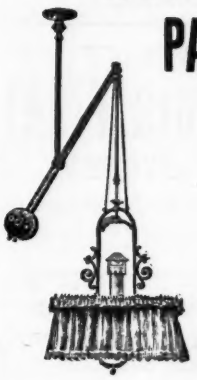
MAKERS OF **THE** **Limited,** **BIRMINGHAM.**



PATENT "SURPRISE" PENDANT,

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The ONLY GAS-PENDANT suitable for Domestic Lighting; a room 18 ft. by 14 ft. being beautifully illuminated with one Incandescent Burner.

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it quite **supersedes** the familiar three-light pendent. We are able to bear witness to the **convenience** of the New Pendant."

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UNDER CONSTRUCTION BY OUR OWN WORKMEN.

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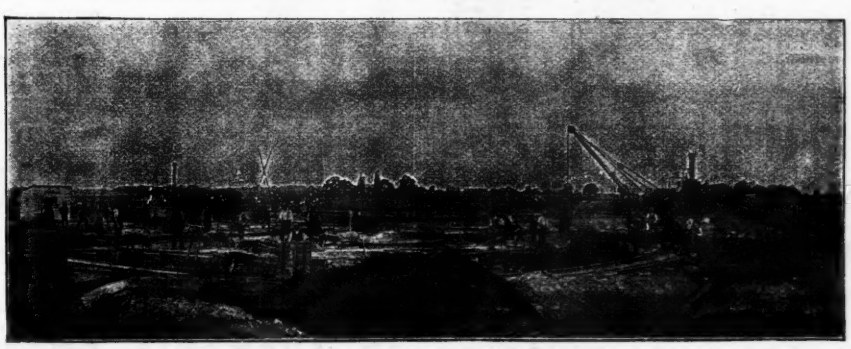

COMPLETE GAS and WATER WORKS ERECTED and SET to WORK, including ALL MAINS.

J. & H. ROBUS, Engineering Contractors,

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For Carbonizing Advt. see last Issue.

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Established 1860.

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Patent Automatic Machinery

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Full Particulars may be obtained from the Sole Makers,

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[See Illustrated Advertisement, Dec. 6, p. 1323.]

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Is the newest in the Market, and is the outcome of practical experience in Sulphate Making.

Old Systems easily and cheaply converted.

ANY SIZE ERECTED COMPLETE AT HOME OR ABROAD.

Makers of Self-Emptying Saturators.

Write for Particulars, Testimonials, and References to

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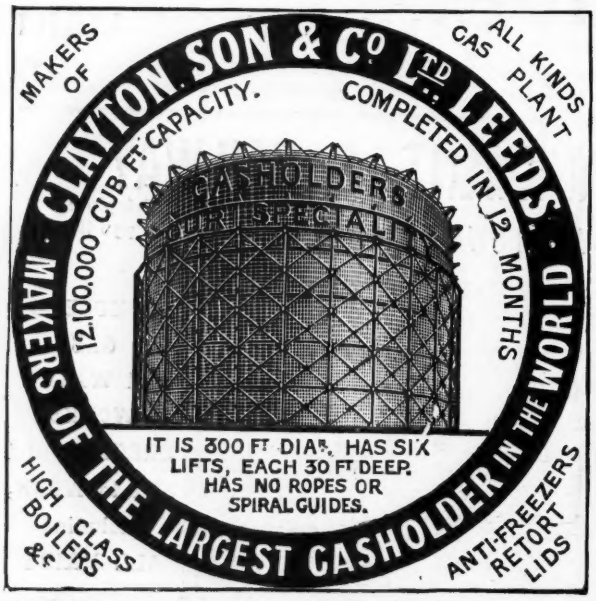
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ALL KINDS GAS PLANT
12,100,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
GASHOLDERS
SPECIALITY
IT IS 300 FT DIAM. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
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THE

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LIGHT SYNDICATE,

THE

PIONEERS OF NO CHIMNEYS,

still hold their own on the market for the

HIGHEST CANDLE POWER

for each Cubic Foot of Gas at ordinary Pressures.

The Syndicate's Three-Light Cluster, governed to consume only 24 Cubic Feet of Gas per Hour, gives

550-CANDLE POWER,

which speaks for itself.

The Syndicate works under the

BANDSEPT PATENTS;

and Bandsept, who was the first to adopt the Injector Principle, is

STILL AHEAD OF ALL RIVALS;

and the combination of his Burners with Welsbach Mantles can be fearlessly tested against any others

ON THE MARKET.

Call and see these Burners

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LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
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ESTABLISHED 1826.

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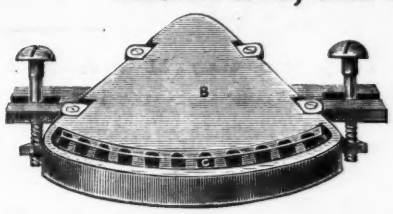
MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

MOSLEY'S
(Patent)
GAS-FIRES
ARE THE
MOST ECONOMICAL, SIMPLEST, CHEAPEST, and BEST.



They are easily fixed to any ordinary Grate. The shapes correspond with the bottom of the grate. Hence the current of air passes from the front to the back of the fire, heating the fuel throughout.

Write for full Particulars and Low Prices to the Makers:

THE LAMP MANUFACTURING CO., LTD.
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IMPROVED
Water-Cooled Condensers
MANCHESTER.

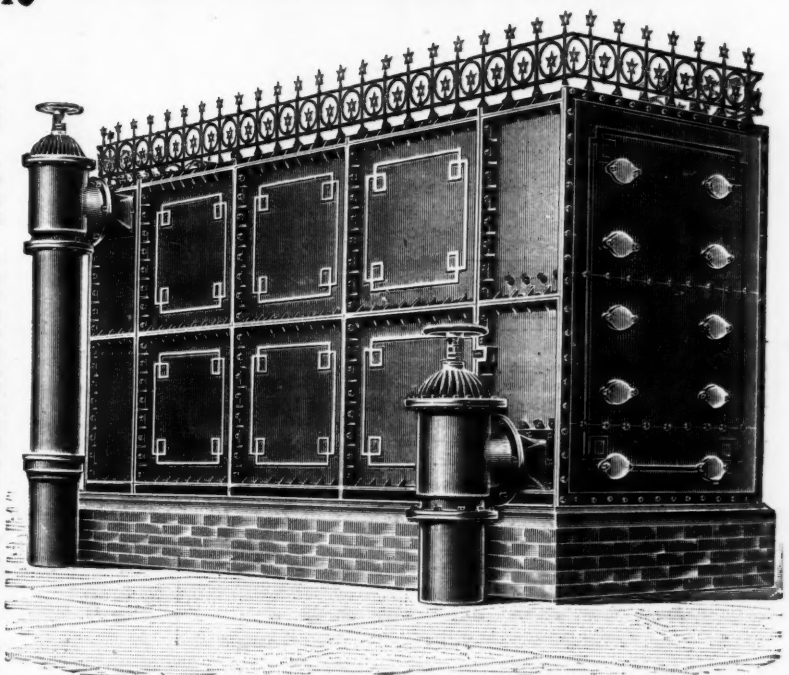
This water-cooled Gas Condenser is designed to work against the great variations of temperature between day and night, sunshine and shade, summer and winter, which are found in this and other countries.

Water being the cooling medium, the temperature of the gas can be kept under control better than with air; and the gas can be sent forward to the purifying plant at the proper temperature for efficient and economical purification.

The cold water enters at the bottom, and gradually rises to the top as the water absorbs heat, thus causing the warm gas to meet the warm water first, and to leave the Condenser in contact with water at any desired temperature by simply regulating the feed-water tap. The gas is thus **cooled progressively, uniformly, and effectually.** The simple construction of this Condenser affords a large cubical capacity, so that the gas remains in a considerable time, and secures all the advantage due to slow-speed condensation. Every part of the Condenser is easily accessible, and by removing the end plates the whole of the interior can be got at. It can be erected under cover, and protected from extremes of heat or cold.

R. & J. DEMPSTER, LTD., recommend this Condenser to be used as a Finishing Condenser, after the gas has already passed through the ordinary Annular or Air Condensers.

Condensers of this type equal to 10,500,000 cubic feet per 24 hours already erected and at work.



From a Photograph of Condenser erected at the Gas-Works, Widnes. Capacity 1,500,000 cubic feet per 24 hours.

W. PARKINSON & CO.'S
"DRAW-PLATE" GAS-FIRES.

A Real Novelty.

Absolutely no Smell when first lit.
Invaluable for use in Bed-Rooms.
Specially adapted for Invalids and Bronchitis Patients.
Ensures a plentiful supply of Pure Air

Adapted to most of our well-known Patterns, also to a new Pattern—

THE "CRYSTAL."

"DRAW-PLATE" UP.

"DRAW-PLATE" DOWN.

SPECIAL POINTS.

Massive and Bold in Design.
Parkinson's Patent "Draw-Plate."
Art Tiles fitted at Sides and Top.
Parkinson's Patent Circulating-Burner, which does not Light Back, and produces a steady, regular Flame.
Open Canopy and Special Air-Heating Arrangement, producing a good Circulation of Pure, Warm Air.

DIMENSIONS, INCLUDING TRIVET.

Height over all	32 inches.
Width	25 "
Back to Front	10 "
Width of Fire	10½ "
Size of Flue-Pipe	3 "
Height of top of Flue from Floor	20 "

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LONDON.
Telegrams: "INDEX." Telephone No. 778 King's Cross.

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BIRMINGHAM.
Telegrams: "GASMETERS." Telephone No. 1101.

(See also Advt., p. 1342.

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